



**SOUTHEAST ROCKFORD
GROUNDWATER CONTAMINATION
PHASE II
SAMPLING AND ANALYSIS PLAN**

APRIL 1993

Prepared For:

**ILLINOIS ENVIRONMENTAL
PROTECTION AGENCY
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SAMPLING AND ANALYSIS PLAN

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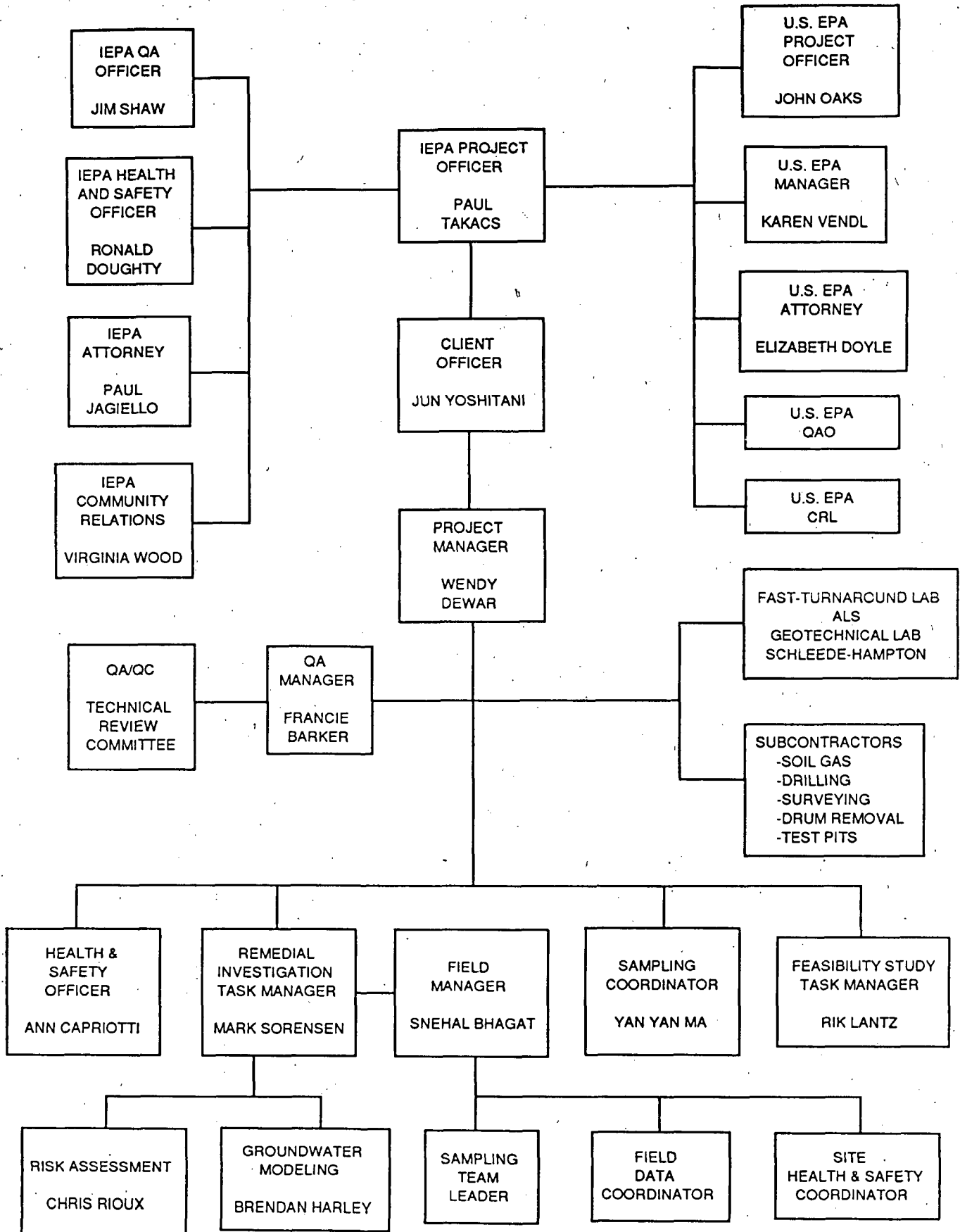
1.0 INTRODUCTION

1.1 OBJECTIVES OF SAMPLING PROGRAM

This Sampling and Analysis Plan (SAP) describes the field activities required for the Phase II Remedial Investigation for the Southeast Rockford Groundwater Contamination Study. The objectives of the sampling program are as follows:

- Gather additional information on the nature and distribution of groundwater contamination in the study area;
- Evaluate potential source areas defined in Phase I;
- Determine aquifer characteristics to allow evaluation of contaminant transport rates and directions;
- Determine the extent of groundwater contamination in the bedrock within the study area;
- Collect data to support preliminary screening of remedial alternatives;
- Collect data to support groundwater modeling; and
- Conduct a risk assessment.

**FIGURE 1-1
SOUTHEAST ROCKFORD PHASE II RI
ORGANIZATION CHART**



1.2 SAMPLING TEAM RESPONSIBILITIES

Field sampling will be performed by Camp Dresser & McKee (CDM). The project organization chart is shown in Figure 1-1. Responsibilities of the sampling team are described below.

Field Manager

The Field Manager (FM) will be responsible for assigning the sampling team responsibilities (in conjunction with the Site Manager), as well as overseeing all field activities. The FM will coordinate mobilization and demobilization for the CDM sampling team, as well as for any subcontractors. The FM will be responsible for keeping the Site Manager up to date on all sampling and subcontractor activities.

Sampling Team Leader

The Sampling Team Leader (STL) will be responsible for the sampling efforts, will assure the availability and maintenance of all sampling equipment and materials, and will maintain an adequate supply of shipping and packing materials. The STL will supervise the completion of all chain-of-custody records, the proper handling and shipping of the samples collected, be responsible for the accurate completion of field log books, and provide close coordination with the Field Data Coordinator (FDC) and the Field Manager (FM). The STL or FM will be present whenever samples are collected.

Sampling Team Member(s)

The Sampling Team Member(s) (STM) will perform field measurements, collect samples, prepare samples for shipping, and decontaminate sampling equipment as directed by the STL.

Field Data Coordinator

The Field Data Coordinator (FDC) will remain in the support area and will accept custody of samples from the sampling team. The FDC will be responsible for the completion of all chain-of-custody and sample traffic control forms. The FDC will also be responsible for maintaining communications with on-site personnel and off-site laboratory personnel, as well as for logging all communications and site entries and departures.

Site Health and Safety Coordinator (SHSC)

The SHSC is responsible for daily supervision and documentation of all safety, decontamination, environmental monitoring and field medical monitoring activities. The SHSC is responsible for assuring that all field personnel comply with the provisions of the CDM Health and Safety Assurance Manual and site Health and Safety Plan. The SHSC has the authority to suspend site work if conditions become unsafe, if HSAM/HSP requirements are not met, or if he/she determines that an upgraded level of protection may be required. The SHSC is responsible for designating and marking restricted areas during various site activities and for redesignating these areas when it is appropriate to do so.

Safety Technician

The Safety Technician (a designated member of the sampling team) will aid other sampling team members with the donning and doffing of protective clothing, decontamination of sample containers and equipment, and will be available to replenish miscellaneous supplies, such as ice and vermiculite, as needed. The Safety Technician will report directly to the SHSC in health and safety related duties and will assume the responsibilities of the SHSC in the event of his/her absence from the site or in an emergency.

1.3 SCOPE OF SAMPLING ACTIVITIES

The scope of sampling activities detailed by this plan include various phases of collection and analysis that will be performed during this investigation. Soil samples will be collected for chemical analysis during the advancing of an estimated 47 subsurface borings and two test pits; additional soil samples will be collected for geotechnical, lithological and chemical analysis during the installation of an estimated 50 groundwater monitoring wells. During drilling of certain monitoring wells, approximately 80 groundwater samples will be collected from the borehole for screening purposes. An estimated 148 groundwater samples will be collected from existing and newly installed groundwater monitoring wells. Further, an estimated 14 samples will be collected of indoor and ambient air, and an estimated 20 samples will be collected of air adjacent to test pits during excavation. Table 1-1 is a summary of the sampling and analysis program. The numbers of wells, borings and samples installed or collected during Phase II will depend on the results of certain ongoing field activities (including soil gas and soil boring work, and vertical profiling of groundwater); as a result, the actual numbers of wells, borings and samples installed or collected will likely vary somewhat from those given in this SAP, or in the Work Plan and QAPP.

Other activities that will be performed during the field investigation are hydraulic conductivity tests of the aquifers, a field survey to determine the elevations of the groundwater monitoring wells, and groundwater elevation measurements.

TABLE 1-1

SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

Sample Matrix	Field Parameters	Laboratory Parameters	Investigative Samples ¹	QC Samples		Matrix Total
				Field Duplicates	Field Blank	
Subsurface soil samples collected during drilling of borings and monitoring wells	Qualitative organic vapor screening with Hnu or OVA	CLP RAS Volatile Organics ^{2,5}	123	13	-	136
		CLP RAS B/N/A Extractable Compounds ^{2,5}	123	13	-	136
		CLP RAS Pesticides/PCB's ^{2,5}	123	13	-	136
		CLP RAS Metals ^{3,5}	123	13	-	136
		CLP RAS Cyanide ⁵	123	13	-	136
	None	CLP SAS for TOC ⁵	30	3	-	33
		Geotechnical parameters: grain-size analysis	5	1	-	6
Subsurface soils collected during excavation of test pits	Qualitative organic vapor screening with HNu or OVA	Geotechnical parameters: falling-head permeability	20	-	-	20
		CLP High-Concentration Organics	8	1	-	9
		CLP High-Concentration Inorganics	8	1	-	9
		CLP TCLP Parameters	4	1	-	5

1. Frequency of collection for all investigative and QC samples is 1.
2. Contract Laboratory Program Routine Analytical Services (CLP RAS) volatile, extractable and pesticide/PCB compounds are listed in Tables 3-1 through 3-3 of the QAPP.
3. Contract Laboratory Program Routine Analytical Services (CLP RAS) metals parameters are listed in Table 3-4 of the QAPP.
4. CLP SAS parameters for volatile organics are listed in the SAS request forms in Appendix B of the QAPP.

5. No extra sample volume is required for soil matrix spike/matrix spike duplicate (MS/MSD) samples.
6. Samples collected for MS/MSD analysis will be collected at double the volume.
7. Performance evaluation samples will be shipped at a frequency of one per group of 20 or fewer samples.
8. One trip blank will be shipped with each shipment of volatile organics.
9. MS/MSD's will be collected at a frequency of one per group of 20 or fewer samples.

(continued)

TABLE (continued)

Sample Matrix	Field Parameters	Laboratory Parameters	Investigative Samples	QC Samples		
				Field Duplicates	Field Blank	Matrix Total
Groundwater samples from 31 Phase II source investigation wells	pH, temperature, conductivity	Drinking Water Level Analysis for Volatile Organics from CLP SAS ^{4,7,8}	31	4	4	39
		CLP RAS Pesticide PCBs ^{2,6,9}	31	4	4	39
		CLP RAS Compounds B/N/A Extractable ^{2,6,9}	31	4	4	39
		CLP RAS Metals (filtered) ³	31	4	4	39
		CLP RAS Cyanide (unfiltered)	31	4	4	39
Groundwater samples from 33 Phase I wells, 19 Phase II groundwater investigation wells, 21 ISWS wells, and 19 industrial wells.	pH, temperature, conductivity	Drinking Water Level Analysis for Volatile Organics ^{4,7,8}	92	10	10	112
Groundwater samples from 25 of the above-noted wells.	pH, temperature, conductivity	CLP SAS analysis for TDS/TSS	25	3	3	31

- Frequency of collection for all investigative and QC samples is 1.
- Contract Laboratory Program Routine Analytical Services (CLP RAS) volatile, semi-volatile and pesticide/PCB compounds are listed in Tables 3-1 through 3-3 of the QAPP.
- Contract Laboratory Program Routine Analytical Services (CLP RAS) metals parameters are listed in Table 3-4 of the QAPP.
- CLPS SAS parameters for volatile organics are listed in the SAS request forms in Appendix B of the QAPP.
- No extra sample volume is required for soil matrix spike/matrix spike duplicate (MS/MSD) samples.
- Samples collected for MS/MSD analysis will be collected at double the volume.
- Performance evaluation samples will be shipped at a frequency of one per group of 20 or fewer samples.
- One trip blank will be shipped with each shipment of volatile organics.
- MS/MSD's will be collected at a frequency of one per group of 20 or fewer samples.

(continued)

TABLE (continued)

Sample Matrix	Field Parameters	Laboratory Parameters	Investigative Samples	QC Samples		Matrix Total
				Field Duplicates	Field Blank	
		CLP SAS analysis for minerals (conductivity, alkalinity, fluoride, chloride, sulfate, silica)	25	3	3	31
		CLP SAS analysis for nutrients (ammonia, COD, total Kjeldahl nitrogen, nitrate, nitrite, TOC, total phosphorus)	25	3	3	31
Groundwater samples from 25 residential wells.	pH, temperature, conductivity	Drinking Water Level Analysis for Volatile Organics ^{4,7,8}	25	3	3	31
Groundwater samples collected during drilling, for screening (vertical profiling) purposes.	pH, temperature, conductivity	Fast-turnaround Analysis for halogenated VOCs	80	8	8	96
Air samples from 14 residential basements (including 2 background samples; inside and outside at each location).	None	EPA method TO-14 for VOCs	28	3	3	34
Air samples adjacent to test pits.	None	EPA method TO-1 for VOCs	20	2	2	24

- Frequency of collection for all investigative and QC samples is 1.
- Contract Laboratory Program Routine Analytical Services (CLP RAS) volatile, semi-volatile and pesticide/PCB compounds are listed in Tables 3-1 through 3-3 of the QAPP.
- Contract Laboratory Program Routine Analytical Services (CLP RAS) metals parameters are listed in Table 3-4 of the QAPP.
- CLPS SAS parameters for volatile organics are listed in the SAS request forms in Appendix B of the QAPP.
- No extra sample volume is required for soil matrix spike/matrix spike duplicate (MS/MSD) samples.
- Samples collected for MS/MSD analysis will be collected at double the volume.
- Performance evaluation samples will be shipped at a frequency of one per group of 20 or fewer samples.
- One trip blank will be shipped with each shipment of volatile organics.
- MS/MSD's will be collected at a frequency of one per group of 20 or fewer samples.

2.0 PROJECT DESCRIPTION

The Southeast Rockford Phase II Remedial Investigation is designed to gather specific information necessary to determine if the site presents a hazard to human health, welfare or the environment, and to evaluate feasible remedial alternatives and/or the need for additional studies.

2.1 STUDY AREA BACKGROUND

Previous sampling events in the study area conducted by the Illinois Department of Public Health (IDPH), U.S. EPA's Technical Assistance Team (USEPA TAT), the Illinois Environmental Protection Agency (IEPA), the Illinois State Water Survey (ISWS), and the Phase I Remedial Investigation have indicated that an east-west trending plume of groundwater contaminated with volatile organic compounds (VOCs) extends from the vicinity of Brooke Avenue and the Rock River to east of Balsam Lane and Bavarian Lane. VOC-contaminated groundwater has also been detected in other portions of the study area near currently and formerly operating industrial facilities.

The principal VOCs detected in the study area include 1,1,1-trichloroethane (TCA), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), 1,1-dichloroethene (1,1-DCE), tetrachloroethene (PCE), 1,1-dichloroethane (1,1-DCA), and vinyl chloride. The maximum concentrations of these compounds range from approximately 100 parts per billion (ppb) to 12,000 ppb. In addition to VOC contamination of groundwater, the IEPA June 1990 Operable Unit remedial investigation indicated that groundwater is locally contaminated with arsenic, cadmium, chromium, and lead. Table 3-1 in the Quality Assurance Project Plan summarizes the historical concentration ranges of VOCs and metals in the Southeast Rockford study area.

A summary of the extent of known contamination, the objectives of the Phase II Remedial Investigation, existing geologic information, site history and previous investigations is provided in Sections 1, 2 and 3 of the Work Plan.

The study area for Phase II is predominantly an urban and suburban residential area that includes scattered industrial, agricultural, retail and commercial operations. Numerous industrial facilities are located near Harrison Avenue between the Rock River and 20th Street. Other industrial areas are situated in the vicinity of 24th Street and Laude Drive, Harrison Avenue and Alpine Road, Sandy Hollow Road and Alpine Road, near the Rock River in the western part of the study area, and elsewhere in the study area. Agricultural areas are present in the southeastern portion of the study area as well as in areas to the east and south of the study area.

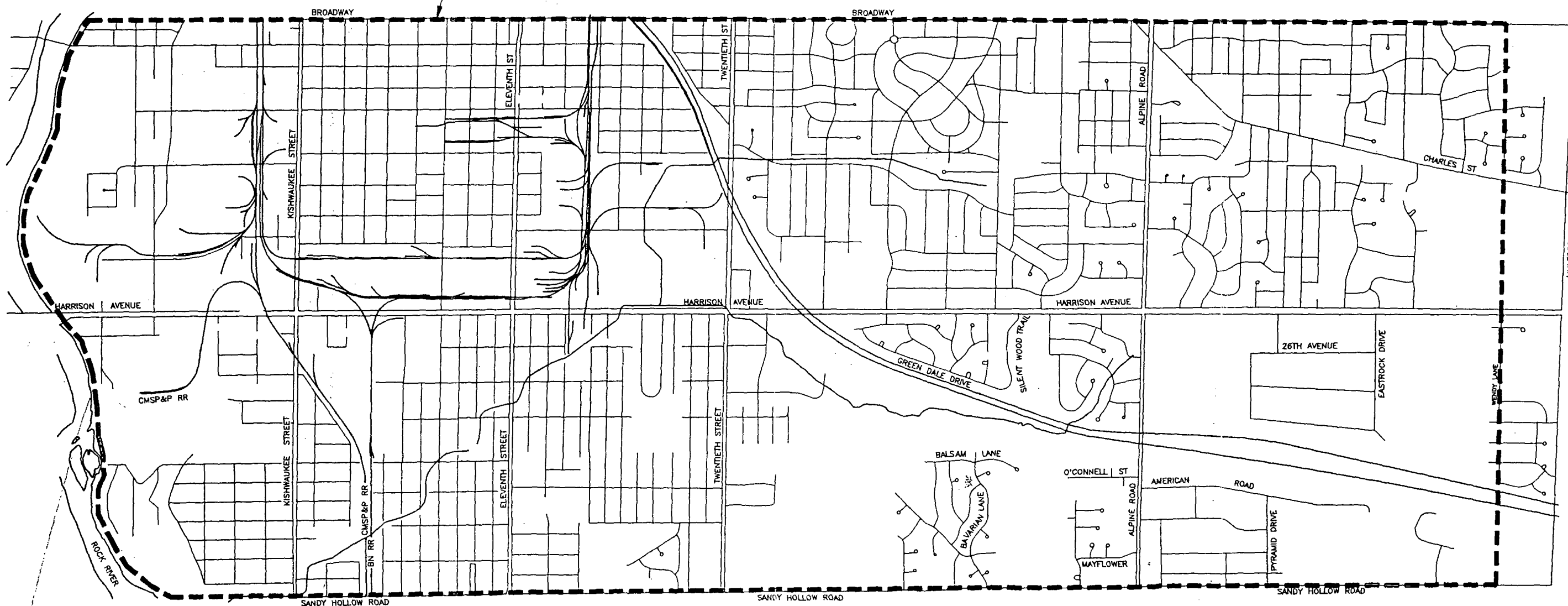
The study area is predominantly flat-lying and slopes gently westward toward the Rock River, but locally contains low-relief hilly areas. Maximum topographic relief across the study area is approximately 120 feet. A small concrete-lined drainage ditch runs across the central and western portions of the study area and discharges to the Rock River at the southwestern corner of the study area.

The area of concern is located in southeast Rockford in Winnebago County and consists of approximately 10 square miles in Sections 1, 2, and 3, T43N, R1E, Sections 4, 5, and 6, T43N, R2E, Sections 31, 32 and 33, T44N, R2E, and Sections 34, 35 and 36, T44N, R1E. The study area is bounded by Broadway to the north, Sandy Hollow Road to the south, Wendy Lane in the eastern portion of Section 4 to the east and the Rock River to the west. The study area is shown in Figure 2-1. The present study area has been expanded in all directions from the original site boundaries, which were used to score the site for inclusion on the NPL. It has also been expanded from the study area defined in the Operable Unit to include potential source areas located along Alpine Road between Harrison Avenue and Sandy Hollow Road, and has been expanded from the Phase I study area to include the large area between Harrison Avenue and Broadway.



environmental engineers, scientists,
planners, & management consultants

STUDY AREA BOUNDARY



SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION STUDY

STUDY AREA

3.0 GENERAL SAMPLING INFORMATION

3.1 SAMPLE CONTAINERS AND PRESERVATION

All groundwater and soil samples will be collected in laboratory-decontaminated sample bottles and jars provided by the IEPA Bottle Repository. At drilling locations (soil borings and monitoring wells), concentrations of contaminants are anticipated to be either low or medium concentrations as designated by the USEPA Contract Laboratory Program. Soil samples from test pits are anticipated to be at medium or high concentrations. Sampling, handling and shipping of the samples will be performed in accordance with these anticipated concentrations. In the event that contaminant levels in borings or wells are discovered to be greater than medium concentrations, these samples will also be handled in accordance with high concentration procedures. Sample containers and preservation will conform to the October 27, 1989 USEPA Region V Sample Handling Manual as found in Appendix A.

The sample containers and their preservation will be as follows:

Groundwater Samples

- Four 40-ml glass VOA vials will be collected at each groundwater monitoring well location for low-detection limit volatile organics analysis.
- One 1-liter high-density polyethylene sample bottle will be used to collect filtered groundwater samples for dissolved metals analysis at each location. Nitric acid (HNO_3) will be added as a preservative. Proper preservation will be determined with $\text{pH} < 2$. The pH of the preserved sample will be determined by the sampler with pH paper. Filtering will be performed during sample collection at the well (i.e., within 15 minutes of sample collection).

- One 1-liter polyethylene sample bottle will be used to collect unfiltered groundwater samples for cyanide analysis at each location. Samples will be preserved with sodium hydroxide (NaOH) to raise the pH > 12. The pH of groundwater samples collected for cyanide will be checked with pH paper by the sampler.
- One 1-liter polyethylene sample bottle will be used to collect samples for analysis of TDS and TSS at certain locations.
- Three one-liter amber glass bottles will be used to collect groundwater analyzed for base/neutral/acid extractable and pesticide/PCB compounds.
- One 1-liter high-density polyethylene bottle will be used for certain samples for analysis of minerals (conductivity, alkalinity, fluoride, chloride, sulfate and silica).
- One 1-liter polyethylene bottle will be used for certain samples for analysis of nutrients (ammonia, COD, total kjeldahl nitrogen, nitrate, nitrite, TOC, total phosphorus). Samples will be preserved with 2 ml of 1:1 H₂SO₄ to lower the pH below 2.
- At sample collection points where duplicate samples will be collected, double sample volume for volatile organics, extractables, pesticides, metals, cyanide, minerals and nutrients will be supplied to the designated lab for analysis.
- At sample collection points where matrix spike/matrix spike duplicates (MS/MSD) samples will be collected, double sample volume for semivolatile analysis will be supplied to the designated laboratory. No extra sample volume for dissolved metals, cyanide, minerals or nutrients, TDS or TSS will be required or supplied to the laboratory for MS/MSD analysis.

- All water samples will be cooled at 4°C in an iced cooler following individual sample collection .

Soil Samples

In the following discussion, low-concentration samples refer to subsurface soil samples collected during drilling, and medium-concentration samples refer to test pit soil samples which are not saturated with product; high-concentration samples are soil samples from test pits which are saturated with product.

- Low- and medium-concentration soil samples collected for metals and cyanide analysis will be collected in either one 8-oz. wide mouth glass bottle or two 4-oz. wide-mouth glass bottles.
- Low- and medium-concentration soil samples collected for semivolatiles will also be collected in either one 8-oz. or two 4-oz. bottles.
- Low- and medium-concentration soil samples collected for volatiles will be placed in two 120-ml wide-mouth glass jars.
- High-concentration samples for organics analysis (VOCs and semivaolatiles combined) will be collected in one 8-oz. wide-mouth jar.
- High-concentration samples for metals and cyanide will be collected in one 8-oz. wide-mouth glass jar.
- Soil samples (low-concentration) analyzed for total organic carbon (TOC) will be collected in one 4-oz. wide-mouth jar.

- Soil samples from test pits to be analyzed for TCLP parameters will be collected in two 8-oz. wide-mouth glass jars.
- No extra sample volume will be collected for MS/MSD analysis.
- Duplicate samples will be collected at double volume for all parameters in their respective sample containers.
- All soil samples will be cooled to approximately 4°C in an iced cooler following individual sample collection.

A summary of soil and water sample bottles, their size and construction material, and sample matrix and holding times is given in Tables 3-1 and 3-2. QC requirements for analytical samples are discussed in detail in Section 7.

3.2 SAMPLE HOLDING TIMES

The sample holding times for soil and water samples are listed on Tables 3-1 and 3-2. To expedite sample analysis, the samples will be shipped to the laboratory (CLP) via an overnight carrier (i.e., Federal Express) or delivered (ALS) on the day of sample collection, or the day after.

3.3 SAMPLE PACKAGING AND SHIPMENT

Following sampling, the sample bottle exteriors will be decontaminated near the sampling location, or rinsed with potable or distilled water prior to shipment. The Field Manager will help the Field Data Coordinator prepare documentation and package sample bottles for shipment according to the following procedures:

TABLE 3-1

**SAMPLE VOLUMES, CONTAINERS, AND PRESERVATION TECHNIQUES
LOW AND MEDIUM CONCENTRATION**

<u>Analysis</u>	<u>Container</u>	<u>Preservative</u>	<u>Maximum Holding Time</u>	<u>Volume of Sample</u>	<u>Matrix</u>
Base/neutral/acid extractables, pesticides/PCBs	Three one-liter amber glass bottles with Teflon lined cap	Cool, 4°C	5 days until extraction. Analyze 40 days after extraction	Fill bottle to neck	Water
Volatiles	Four 40-ml volatile organic analysis (VOA) vials	2 drops concn. HCl to pH < 2; cool, 4°C	7 days	Fill completely (no air bubbles)	Water
Halogenated Volatiles (for vertical profiling during drilling)	Two 40-ml VOA vials	2 drops concn. HCl; cool, 4°C	7 days	Fill completely (no air bubbles)	Water
Metals (filtered)	One 1-liter high density polyethylene bottle	5-ml 1:1 HNO ₃ to pH < 2	180 days (28 days for mercury)	Fill to shoulder of bottle	Water
Cyanide (unfiltered)	One 1-liter polyethylene bottle	5-ml 6N NaOH to pH > 12; cool, 4°C	12 days	Fill to shoulder of bottle	Water

<u>Analysis</u>	<u>Container</u>	<u>Preservative</u>	<u>Maximum Holding Time</u>	<u>Volume of Sample</u>	<u>Matrix</u>
Minerals Alkalinity Fluoride Chloride Sulfate Silica	One one-liter high density polyethylene bottle	Cool, 4°C	14 days	Fill to shoulder of bottle	Water
Nutrients Ammonia COD TKN NO ₃ -NO ₂ TOC Total Phosphorus	One one-liter polyethylene bottle	2-ml 1:1 H ₂ SO ₄ to pH < 2; cool, 4°C	28 days	Fill to shoulder of bottle	Water
TDS and TSS	One 1-liter polyethylene bottle	Cool, 4°C	7 days	Fill to shoulder of bottle	Water
Semi-volatiles (extractables and pesticides/PCBs)	One 8-ounce glass wide mouth bottle with Teflon-lined cap	Iced to 4°C	14 days until extraction and analyzed within 40 days after extraction	Fill no more than 3/4 full	Soil
Volatiles	Two 120-ml glass wide-mouth vials with Teflon lined caps	Iced to 4°C	7 days	Fill completely (No Head Space)	Soil
Metals and Cyanide	One 8-ounce glass wide-mouth bottle	Iced to 4°C	180 days (28 days for mercury) and 12 days, respectively	Fill no more than 3/4 full	Soil

<u>Analysis</u>	<u>Container</u>	<u>Preservative</u>	<u>Maximum Holding Time</u>	<u>Volume of Sample</u>	<u>Matrix</u>
TOC	One 4-ounce glass bottle	Iced to 4°C	28 days	Fill 3/4 full	Soil
Geotechnical (grain-size)	One 8-ounce glass bottle	None	None	Fill 3/4 full	Soil
Geotechnical (falling-head permeability)	One 3-foot long, 2-inch I.D. thin-walled tube (Shelby tube)	None	None	Fill completely as per ASTM method D-1587	Soil
Volatiles	15-liter stainless steel Summa canister	None	30 days	Not applicable	Air
Volatiles	Tenax tube	None	30 days	Not applicable	Air

TABLE 3-2

SAMPLE VOLUME, CONTAINERS, AND PRESERVATION TECHNIQUES

HIGH CONCENTRATION

<u>Analysis</u>	<u>Container</u>	<u>Preservative</u>	<u>Maximum Holding Time</u>	<u>Volume of Sample</u>
Organics	One 4-oz. wide-mouth glass jar	cool to 4°C	Not established	Fill 1/2 to 3/4 full
Inorganics and Cyanide	One 4-oz. wide-mouth glass jar	cool to 4°C	Not established	Fill 1/2 to 3/4 full
TCLP Organic Parameters	One 1-quart wide-mouth glass jar	cool to 4°C	14 days to extraction; 28 days total	Fill 1/2 to 3/4 full
TCLP Inorganic Parameters	One 1-liter wide-mouth glass jar	cool to 4°C	180 days to extraction (28 days for mercury) 56 days total for mercury	Fill 1/2 to 3/4 full

NOTE:

The normal procedures used for preservation and holding of environmental samples for analysis will not apply to the analysis of high concentration samples. Due to the expected high levels of constituents believed to be present in the samples, losses due to lack of preservation after receipt of the samples from the field are not considered a major problem. If the samples are analyzed within the required time as set forth in the SOW, the samples will not require any preservative prior to preparation, but preservation after preparation and prior to analysis (as described in the individual methods) will be required. The medium level preservation requirements thereby apply. (See Table 3-1.)

- Check for proper sample preservation; tighten sample bottle caps securely and seal with tape; mark liquid levels if bottles are partially full.
- Make sure traffic report labels and sample tags are securely attached to the sample container; place each container in a zip-loc baggie, ensuring that labels can be read.
- Samples for medium and high hazard will be packaged one bottle per paint can, with the excess space filled with vermiculite. The sample number and proper DOT hazard classification will be marked on each can. Unknown samples will be marked "Flammable Solid N.O.S. UN1325". The cans will then be placed in coolers with the appropriate DOT labeling.
- Place containers in a cooler lined with two inches of vermiculite or equivalent absorbent material; maintain at 4°C with cold packs or ice sealed in plastic bags; fill remaining space in cooler with additional packing material.
- Place completed chain-of-custody forms and traffic reports in a zip-loc baggie and tape to inside of cooler lid.
- Close cooler and seal with strapping tape; if cooler has a drain port, seal it with tape; place one custody seal across closure at front of cooler and across hinge area at back of cooler, or rear side corner.
- Affix airbill with shipper's and cosignee's addresses to top of cooler; place "This End Up" labels appropriately. Restricted article airbills will be used in shipping medium and high-concentration samples.

Collected and packaged samples will then be shipped to a designated laboratory.

The Field Manager should contact the Sampling Coordinator to confirm sample shipment dates one week in advance for Routine Analytical Services (RAS) sample collection and two weeks in advance for Special Analytical Service (SAS) shipments to CLP. The Field Manager will notify the Sampling Coordinator of any last-minute changes in the sampling schedule.

Upon shipment of samples to the Laboratory, the Field Data Coordinator will call the Sampling Coordinator (before 5:30 p.m. central time on the day of shipment or early the following morning). The Sampling Coordinator must be notified by 2:00 p.m. on Friday for shipments to the CLP for Saturday delivery/pick-up. The Sampling Coordinator will be provided with the following information:

1. Case and/or SAS numbers (if applicable),
2. Name of laboratory(ies),
3. Date of shipment,
4. Carrier, airbill number,
5. Number and matrices of samples shipped, and
6. Information regarding changes and delays pertaining to the activity.

The Sample Identification Record form will be used to record this information. An example of this form is provided as Figure 3-1. A copy must be sent to the Sampling Coordinator with the other sample documents which include copies of the CRL Sample Data Report, SAS Packing List, and Chain-of-Custody forms.

The Central Regional Laboratory Sample Data Report form for samples being sent to the CLP must also be sent to the Sampling Coordinator. These forms are not sent to the CLP.

SHE NAME _____

SITE NUMBER _____

[illegible]

- 1) ONLY ONE CASE NUMBER PER SAMPLE ID RECORD FORM
- 2) LIST TRAFFIC REPORT (SMO) NUMBERS IN NUMERICAL ORDER
(DO NOT LIST ACCORDING TO CRL NUMBERS)

3.4 CHAIN-OF-CUSTODY PROCEDURES

Chain-of-custody will be maintained throughout the sample preparation procedure as described in the Southeast Rockford Quality Assurance Project Plan (QAPP).

- All information required on the custody tag, including the signatures of the sampling team leader and a predesignated location description, will be filled out in the field.
- Prior to relinquishing samples for packaging and shipment, one member of the sampling team will transfer all data contained on the custody tags to a chain-of-custody record, which the team leader must sign.
- The individual who prepared the chain-of-custody record will relinquish the samples to the sample handling technician, who will prepare all CLP traffic reports and affix appropriate traffic report labels to the sample containers.
- The technician will package the samples for shipment making sure that all traffic reports, chain-of-custody records and custody seals are cross-referenced and recorded on the Sample Identification Record Form and that all sample documentation paper work is enclosed.
- If samples are stored temporarily prior to shipment, they will be kept cool (4°C) and placed in a secured storage area. Coolers will be sealed and custody seals affixed just prior to shipment.

3.5 DOCUMENTATION

This section outlines the documentation required for all field activities, sample collection, handling and shipment to be conducted during the Phase II Remedial Investigation.

3.5.1 FIELD LOG BOOKS

Field log books will provide the means of recording pertinent data collected during the performance of RI activities. As such, entries will be described in as much detail as possible so that site personnel can reconstruct a particular situation without reliance on memory.

Field log books will be bound, field survey books. Log books will be assigned to field personnel, but will be stored in the document control center when not in use. Each log book will be identified by the project-specific document number.

The title page of each notebook will contain:

- Person or Organization to whom the book is assigned;
- Book Number;
- Project Name;
- Start Date; and
- End Date.

Entries into the log book will contain a variety of information. At the beginning of each entry, the date, start time, weather, name of all team members present, level of personal protection being used, and the signature of the person making the entry will be recorded. The names of visitors to the site, field sampling or investigation team personnel and the purpose of their visit will be recorded in the field log book. At the end of each day's activity, the log will be closed with the time and signature of the person making the last entry (log-closed line). The log-closed lines and the following log-open lines will be placed so that no unauthorized entries can be made between entries. A typical format is presented in Figure 3-2.

Measurements made and samples collected will be recorded. All entries will be made in ink and no erasures will be made. If an incorrect entry is made, the information will be crossed

Figure 3-2
TYPICAL FIELD NOTEBOOK ENTRY FORMAT

LOG-OPEN TIME: _____ DATE: _____
SIGNATURE: _____
WEATHER: _____

FIELD PERSONNEL: _____

LEVEL OF PERSONAL PROTECTION: _____

EQUIPMENT (NAME/CONTROL NO.): _____
_____ Calibration Date: _____

Station No./Location Description: _____

Film Roll Number: _____ Photograph Numbers: _____
Station No. _____ (Parameter (Units))

Sampling Equipment: _____

<u>No.</u>	<u>Time</u>	<u>Sample Description</u>	<u>Depth</u>	<u>Number</u>	<u>Volume</u>	<u>Chest No.</u>	<u>Comments</u>
_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____

out with a single strike mark. Wherever a sample is collected or a measurement is made, a detailed description of the location of the station, which may include compass and distance measurements, shall be recorded. The number of the photographs taken of the station with a brief description including and the direction faced will be noted. All equipment used to make measurements will be identified, along with the date of calibration.

The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume and number of containers. Sample location identifiers will be assigned prior to sample collection. Duplicates, which will receive a separate CRL sample number, will be noted under sample description.

3.5.2 SAMPLE IDENTIFICATION SYSTEM

U.S. EPA CRL SAMPLE NUMBER

Each sample being sent to the CLP for analysis must have a U.S. EPA CRL sample number, regardless of the laboratory to which it is going. This number will be recorded on the chain-of-custody form and the sample field book. The CRL sample number will consist of nine alpha-numeric characters, as follows:

93RS01xyy

The first six characters (93RS01) will generally remain constant for RI sampling, and signify the following:

93	Fiscal year 1993
R	Indicates samples sent by CDM
S	Designates project manager
01	Designates survey number

The last three characters will vary during the sampling survey. The character "x" is a single digit alpha code designating the type of sample:

- S Sample
- D Duplicate sample
- R Blank sample

The character "yy" is a 2-digit (01 through 99) number designating the sample number. After 99 samples have been collected for the survey, the survey number will be changed (characters 5 and 6). For S-type samples, "yy" is used to consecutively number samples taken during this survey. For duplicate (D-type) samples, "yy" is the same as the sample number of which it is a duplicate. For blank (R-type) samples, "yy" is the consecutive number of blank samples taken during this survey.

EXAMPLE U.S. EPA CRL SAMPLE NUMBERS

- 93RS01S01, 93RS01S02, 93RS01S03
 Samples No. 01, 02, and 03 of Dewar's Survey No. 1.
- 93RS01D02
 Duplicate sample of Sample No. S02.
- 93RS01R01, 93RS01R02
 Blank samples No. 01 and 02.

The CRL sample number(s) will be recorded in the field log book and on all other paperwork and labels and will be cross-referenced to chain-of-custody and shipping documents. A description of the sample location will be entered into the field log book, including compass directions and distances from reference points, if applicable.

SAMPLE LOCATION IDENTIFICATION

Each soil, soil gas, groundwater and vertical profiling groundwater sample will also be assigned a sample location ID in addition to the U.S. EPA CRL number. The first two letters of the sample location ID denotes the sample matrix. The number portion of the location ID will correspond to the monitoring well designations shown on Figure 4-13. Sample matrices will be recorded using the following code:

<u>SAMPLE MATRIX</u>	<u>CODE</u>
Groundwater	GW
Groundwater (vertical profiling during drilling)	VP
Soil (borehole)	SB
Air	AI
Soil (Test Pit)	TP
Other	OT

The designations for groundwater samples collected from the 91 wells installed during Phases I and II of this investigation will consist of six alphanumeric characters, as follows:

GW 101A

"GW" describes the groundwater sample collected from a monitoring well, industrial well or residential well. The numbers 101 through 144 will be the numerical designation for the wells installed during this investigation (as shown on Figure 4-13). The first letter suffix will describe the relative well depth at the well nest. "A" will be the shallowest well in the nest location. Letters "B," "C" etc., will generally reflect successively deeper wells in the respective nest.

For groundwater samples collected during drilling for vertical profiling purposes, the sample location ID will consist of six alphanumeric characters, as follows:

VP113C

This water sample would have been collected from the third (C) vertical profile sampling depth from monitoring well nest 113.

For general purposes other than for sampling, the monitoring wells installed during this investigation will be referred to in a manner similar to that shown above, but with the "GW" becoming "MW". Thus, the groundwater sample listed above would be one collected from well MW-101A. This type of monitoring well designation is unique to the study area. A similar numbering system will be used for the groundwater samples collected from the existing wells. The 21 ISWS wells (MWxx) and the 19 industrial wells (IWxx) are also shown on Figure 4-13. The 25 residential wells to be sampled are listed in Table 5-4.

Subsurface soil samples collected during the RI will have up to seven alphanumeric characters. The first two letters will be the sample code. The next one to three numbers will correspond to the soil boring or monitoring well location. Soil borings will have a one- or two-digit designation, while monitoring wells will have the three-digit designation described above. The letter suffix will document what depth the sample was collected from, with the letter "A" will representing a surface or near-surface sample, "B" a sample from the second depth interval, "C" the third sample, etc. An example is as follows:

SB 112C

This soil sample would have been collected from the third sampling depth interval ("C") from a soil boring ("SB") for well nest MW112. An example of a soil sample collected from a soil boring where no well is to be installed is as follows:

SB16D

This identifier denotes a soil sample that would have been collected from soil boring SB16 at the fourth sampling interval (for most soil borings, the 13.5 to 15-foot sample). In general, subsurface soil samples will be collected at depth intervals of five feet for source investigation wells and borings, and 10 feet for groundwater investigation wells.

Indoor and ambient air samples will be numbered sequentially beginning with AI01. For all sample matrices a final one-letter suffix in parentheses will be added for duplicate or field blank samples. For instance, SG6-01B(D) would represent a duplicate collected for soil gas sample SG6-01B; the suffix "(R)" would represent a field blank for a soil gas or groundwater sample.

Sample designations will be recorded in the sample field book, on the chain-of-custody forms, the traffic reports, the sample identification record form, and on the sample tags affixed to the sample jars.

3.6 SAMPLE DOCUMENTATION FORMS

Sample documentation forms required by the U.S. EPA are numbered and will be accounted for. In the event that a document is voided, it will not be destroyed; instead, voided sample documents will be saved and returned to the Sample Coordinator. Copies of the multiple-copy forms will accompany samples to the laboratory. The other copies will be sent to the Sampling Coordinator immediately following sampling shipment.

A) Chain-of-Custody Form

- 1) One form per shipping container (cooler) will be used.
- 2) Carrier service will not need to sign form if custody seals remain intact.
- 3) Will be used for all samples.

B) Chain-of-Custody Seals

- 1) Two seals per shipping container will be used to secure the lid and provide evidence that samples have not been tampered with.
- 2) Seals will be covered with clear tape.
- 3) Seal numbers will be recorded on Chain-of-Custody Form.
- 4) Seals will be used for all sample shipping containers.

C) Special Analytical Service Packing List

- 1) Up to twenty samples can be listed per form.
- 2) Used only for samples sent to CLP for SAS analysis.
- 3) Samples will be numbered using the SAS number assigned by CLP followed by a hyphen and progressive numerical designations, starting with 1 (e.g. I2000E-1, 2000E-2, 2000E-3, etc.)

- 4) If sampling extends over several days and more than one Packing List is used, care will be taken not to repeat sample numbers.
- 5) Sampler will include bottom 2 copies of form with sample shipment; top copy will be returned to SMO and second copy is sampler's file copy.

D) Sample Tags

- 1) Each sample container will have a Sample Tag affixed to it with string or wire.
- 2) Traffic Report number and Case Number will be recorded in "Remarks" section of tag.
- 3) Sample Tag Numbers will be recorded on Chain-of-Custody Forms.

E) CRL Sample Data Report

- 1) Will be completed for all CLP samples.
- 2) For samples sent to CLP Laboratories, these forms will be sent to the Sampling Coordinator to be forwarded to the RSCC.
- 3) The forms will be necessary for the U.S. EPA to track the samples and ensure data validation.

F) Sample Identification Record Form

- 1) Will provide a means of recording crucial sample shipping and tracking information.

- 2) This form will be maintained for each sample shipment and forwarded to Sampling Coordinator upon sample shipment.

All paperwork accompanying the samples being shipped to the CRL or CLP laboratories will be sealed in a plastic bag that is taped to the inside of the cooler lid. Copies of the chain-of-custody forms, and other paperwork (if possible) will be retained for the field files.

The sample handling technician will maintain lists cross-referencing site sample numbers, custody tag number, SAS numbers, analyses to be performed, custody seal number, shippers' airbill numbers, and consigned laboratories in a bound log book using black ink and on the Sample Identification Record Forms. For more details on sampling paperwork, refer to Appendix A.

4.0 SAMPLING LOCATIONS AND RATIONALE

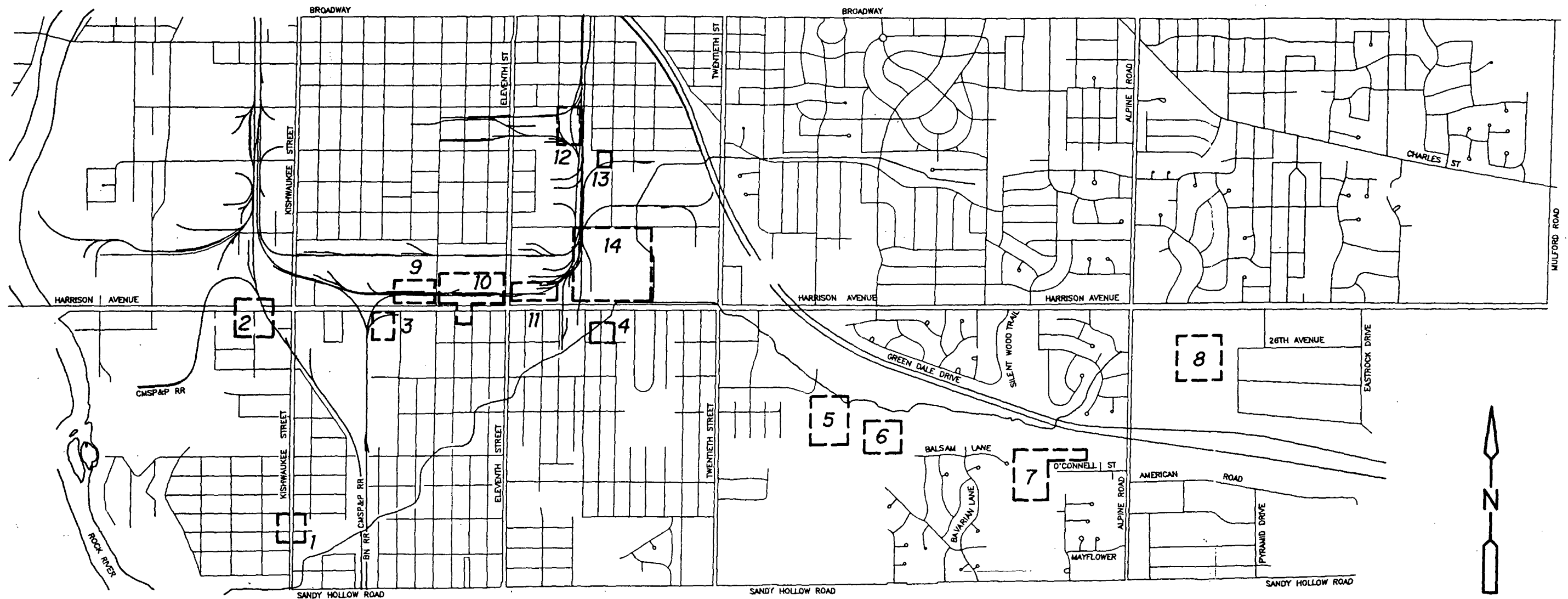
4.1 SOURCE INVESTIGATION

As part of the Phase II source investigation, a soil gas survey is being conducted during January and February 1993, before the Phase II field work covered by this QAPP. The purpose of this soil gas survey is to delineate areas of soil contamination and to aid in identifying source areas that may have contributed to the groundwater contamination that exists in Southeast Rockford. Approximately 212 locations in twelve specific areas (see Figure 4-1) across the study area are being tested for soil gas constituents. The areas to be surveyed for soil gas constituents have been identified as potential source areas based on the results of groundwater sampling conducted during the Operable Unit phase and during Phase I of this study; the results of soil gas work conducted in Phase I; and other information including aerial photographs, site visits, previous IEPA or USEPA studies, and information regarding industrial activities in the study area. Additional details regarding the Phase II soil gas survey are given in "Phase II RI Work Plan and Sampling Plan for Soil Gas Survey" (October 1992).

4.1.1 SOIL BORINGS

Soil borings will be drilled during Phase II in order to provide soil samples to verify elevated soil gas contaminant concentrations defined during the Phase I and Phase II soil gas surveys. Ultimately, soil samples collected from soil borings will allow determination of: 1) whether the respective soil gas areas are actually likely contaminant source areas; and 2) the relative contributions of likely contaminant source areas to the groundwater contamination plumes observed in Southeast Rockford.

The locations of soil borings will depend on the results of the soil gas survey. It is anticipated that, within a given survey area, the soil gas survey will define one or more



NOTE:

PHASE II SOIL GAS SURVEY WORK WILL BE CONDUCTED IN ALL AREAS SHOWN EXCEPT AREAS 6 AND 8.

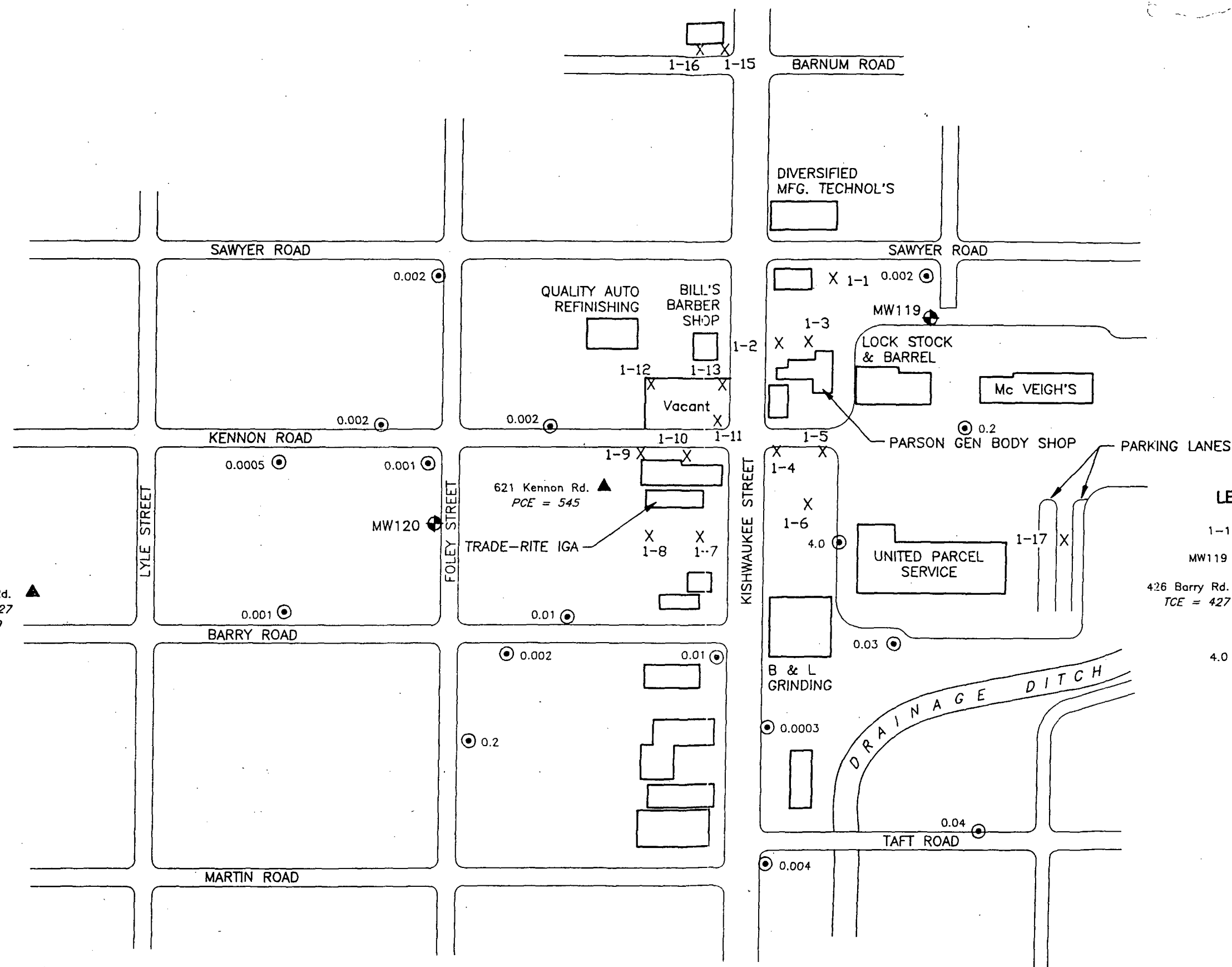
SOUTHEAST ROCKFORD
AREAS OF INVESTIGATION

discrete areas with elevated soil gas concentrations of the target compounds. Borings will be placed as close as possible to the center of each such area of elevated concentrations. If an area is large (more than 50 feet across), more borings may be located. In general, soil borings will be placed at maximum centers of 50 to 100 feet in the areas defined by elevated soil gas concentrations. Approximate soil boring locations (based on preliminary soil gas survey results) are shown on Figures 4-2 through 4-11.

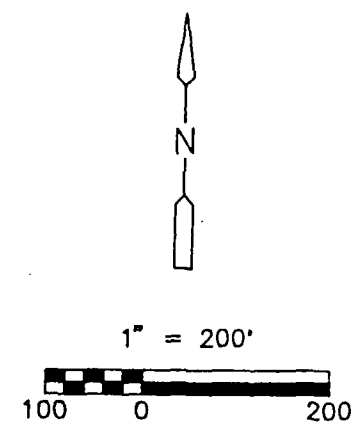
At each soil boring, drilling and sampling will continue until the water table is reached. Subsurface soil samples will be collected at depth intervals of 5 feet to the water table. Samples will be screened for VOC concentrations by the head-space method using an HNu photoionization detector or an OVM flame ionization detector, as discussed in subsection 5.5. Two samples from each soil boring will be selected for laboratory analysis of Target Compound List (TCL) organics and Target Analyte List (TAL) inorganics: the sample with highest VOC concentrations as measured by head-space, and the first sample below the contaminated zone that shows undetectable VOCs by head-space. The rationale for the selection of these samples is that they will provide general upper and lower bounds for VOC concentrations in each soil boring. The other subsurface samples from each boring (containing intermediate head-space values) can then be assumed to contain VOC soil concentrations between the upper and lower bounds indicated by the laboratory analysis.

4.1.2 AREA 7 TEST PITS

The geophysical surveys (terrain conductivity and ground-penetrating radar) in Area 7 delineated areas of disturbed soil and buried debris in unconsolidated sediments. The buried material is located near the ground surface and extends to an unknown depth. Terrain conductivity data indicate that the buried material likely includes metallic debris. Soil gas data from Area 7 indicates that VOCs (TCA, TCE, and PCE) are present at concentrations from less than 1 $\mu\text{g/l}$ to greater than 5,000 $\mu\text{g/l}$.



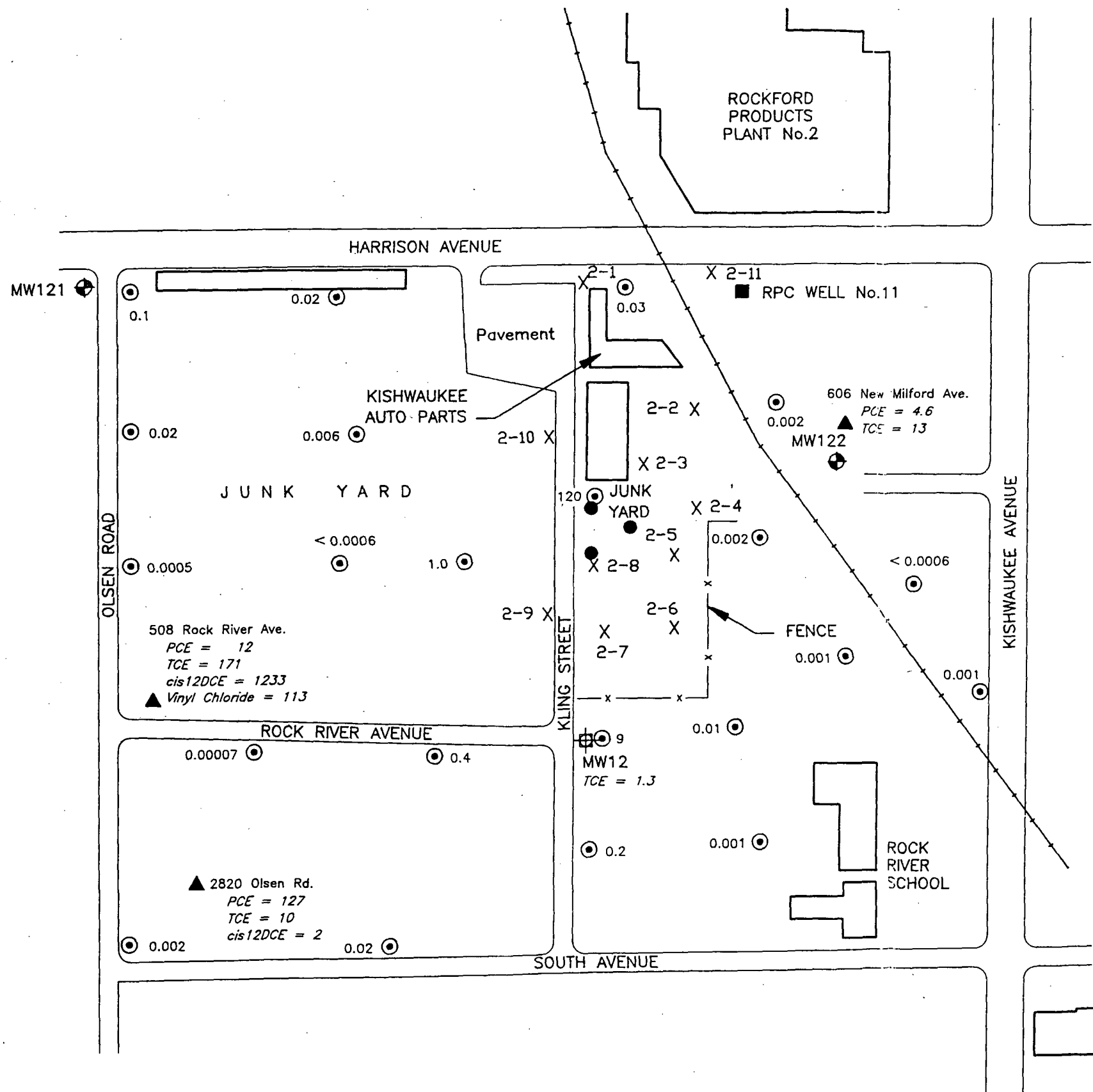
- LEGEND**
- 1-1 X PHASE II SOIL GAS SURVEY POINT
 - MW119 PROPOSED MONITORING WELL NESTS
 - 426 Barry Rd. PRIVATE WELL LOCATION
(With Concentration of Most Abundant
VOC Contaminants in ug/l - Sampled
in Operable Unit 6/90)
 - 4.0 PCE CONCENTRATION IN SOIL GAS,
PHASE I (Sampled 5/91)



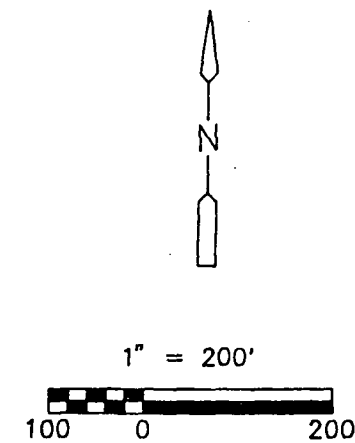
SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION STUDY
POTENTIAL SOURCE
AREA 1

Figure No. 4-2

02/22/93 G. FOSZCZ
P2SAP4-3
7/11/93 P2SAP
1/CAD/1



- LEGEND**
- 2-1 X PHASE II SOIL GAS SURVEY POINT
 - PROPOSED SOIL BORING LOCATION
 - MW125 ● PROPOSED MONITORING WELL NESTS
 - 606 New Milford Ave. ▲ PRIVATE WELL LOCATION
(With Concentration of Most Abundant
VOC Contaminants in ug/l - Sampled
in Operable Unit 6/90)
PCE = 4.6
TCE = 13
 - MW12 ⊕ EXISTING ISWS MONITORING WELL
(With Concentration of Most Abundant
VOC Contaminants in ug/l -
Sampled 8/91)
TCE = 1.3
 - 1.0 ● PCE CONCENTRATION IN SOIL GAS,
PHASE I (Sampled 5/91)

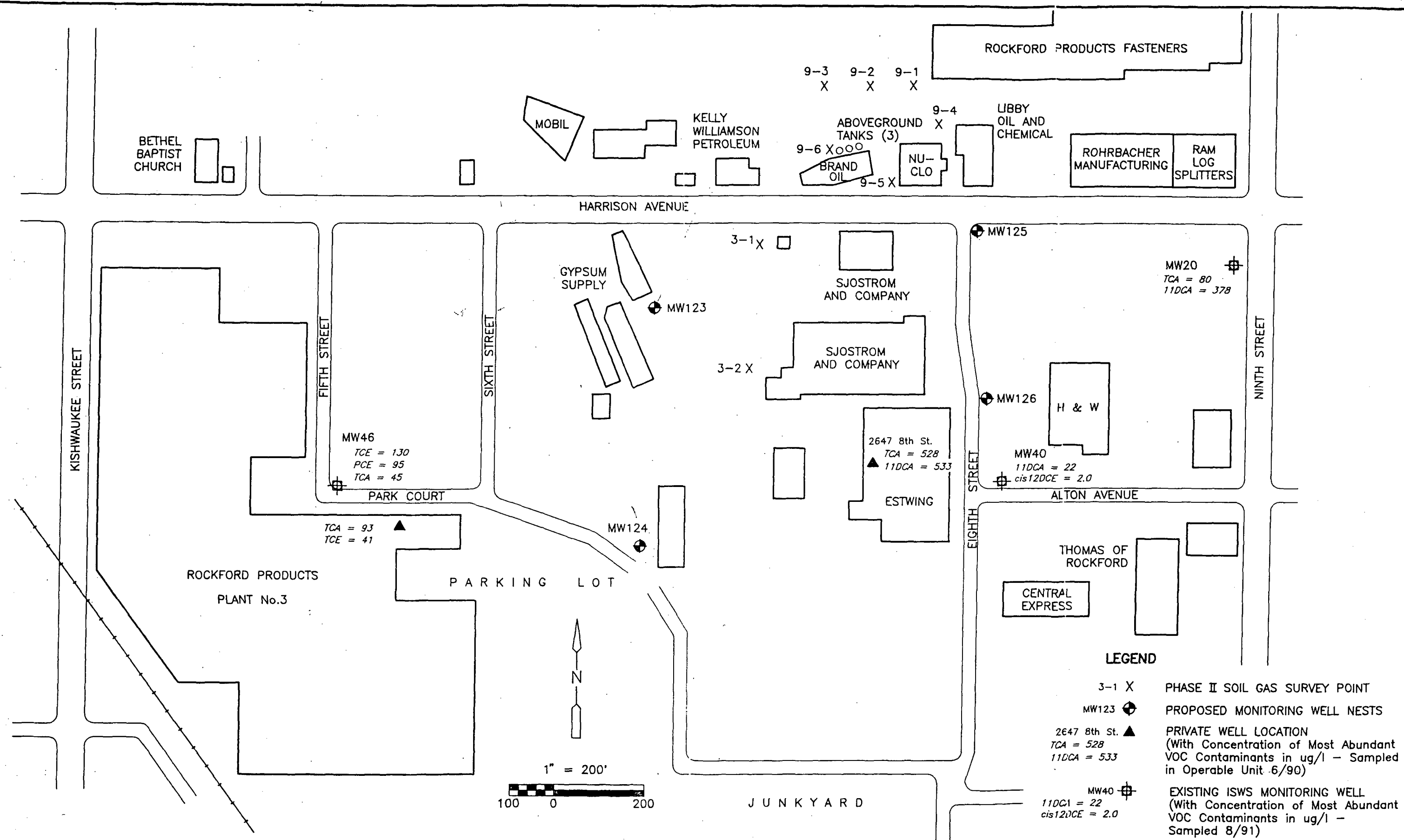


SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION STUDY
**POTENTIAL SOURCE
AREA 2**

02/22/93 G. FOSZC
P2SAP4-4
17/RI/P2SAP

CDM

environmental engineers, scientists,
planners, & management consultants

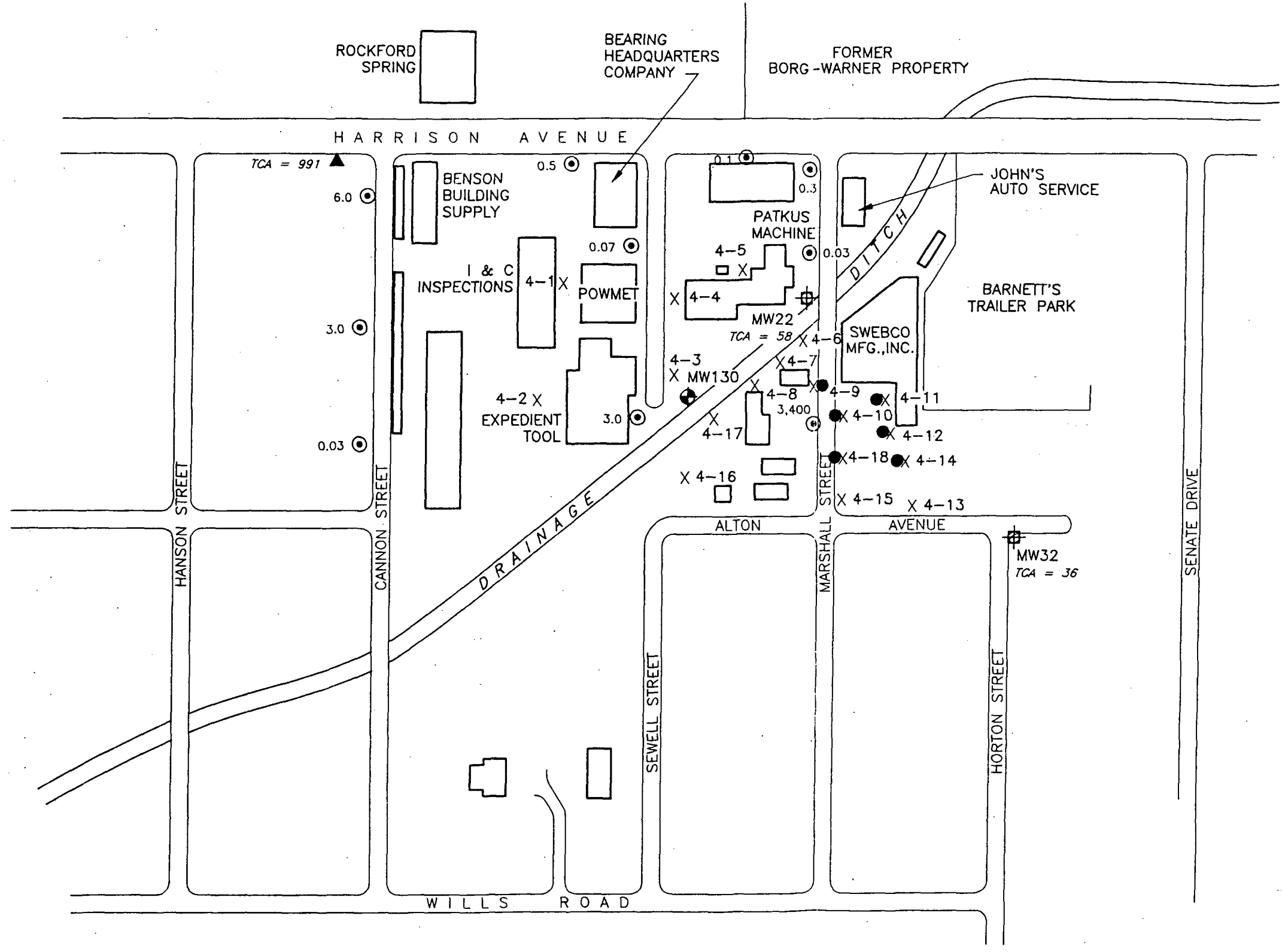


SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION STUDY

POTENTIAL SOURCE
AREAS 3 AND 9

Figure No. 4-4

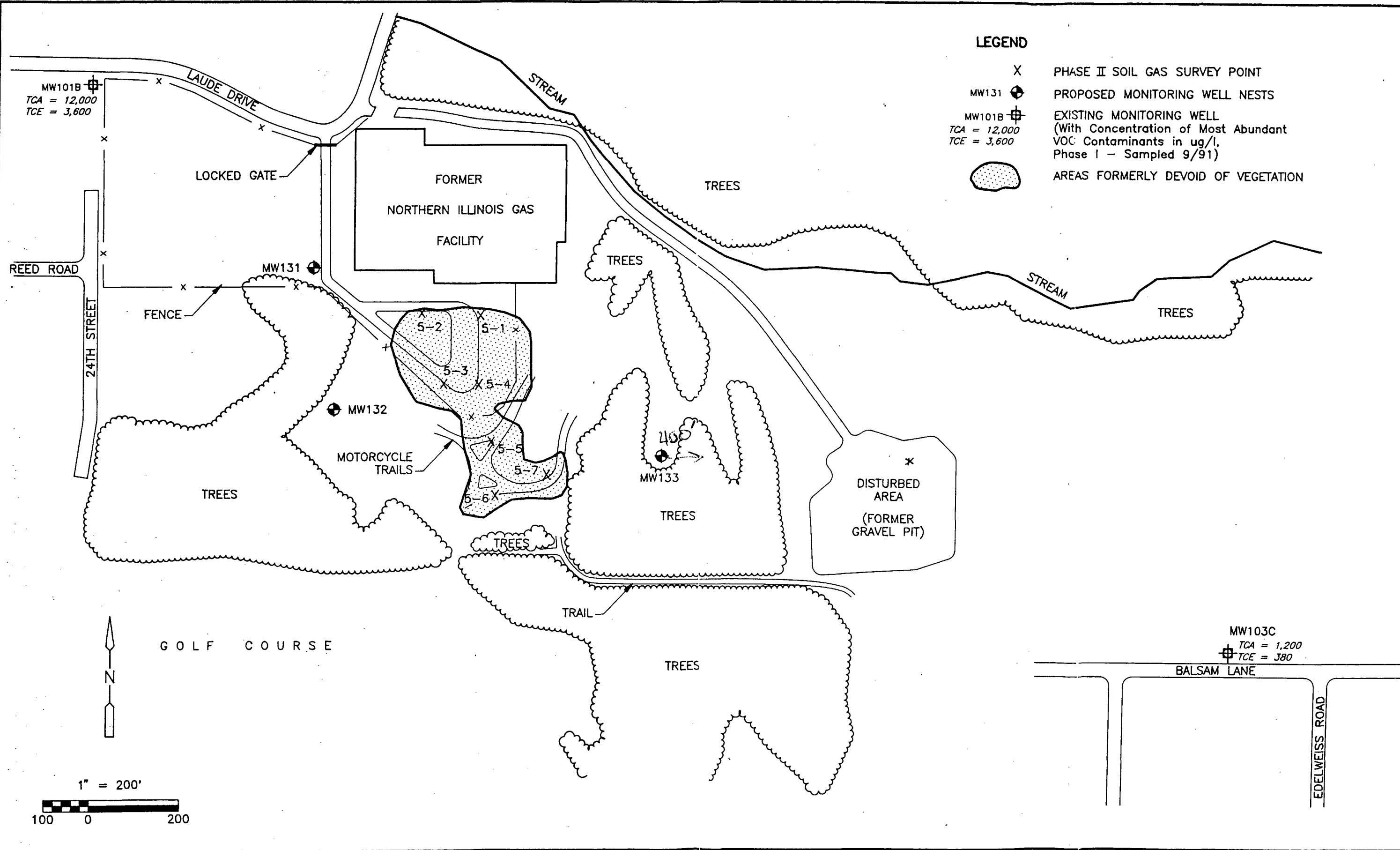
I:\CAD\16\2\RI\P2SAP
P2SAP4-5
02/22/93 G. FOSZCZ



- LEGEND**
- X PHASE II SOIL GAS SURVEY POINT
 - PROPOSED SOIL BORING LOCATION
 - MW133 PROPOSED MONITORING WELL (Downgradient; Upgradient Data Provided by MW32)
 - TCA = 991 PRIVATE WELL LOCATION (With Concentration of Most Abundant VOC Contaminants in ug/l - Sampled in Operable Unit 6/90)
 - 4.0 TCA CONCENTRATION IN SOIL GAS, UG/L; PHASE I (Sampled 5/91)
 - MW32 EXISTING ISWS MONITORING WELL (With Concentration of Most Abundant VOC Contaminants in ug/l, Sampled 8/91)

SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION STUDY
**POTENTIAL SOURCE
AREA 4**

Figure No. 4-5



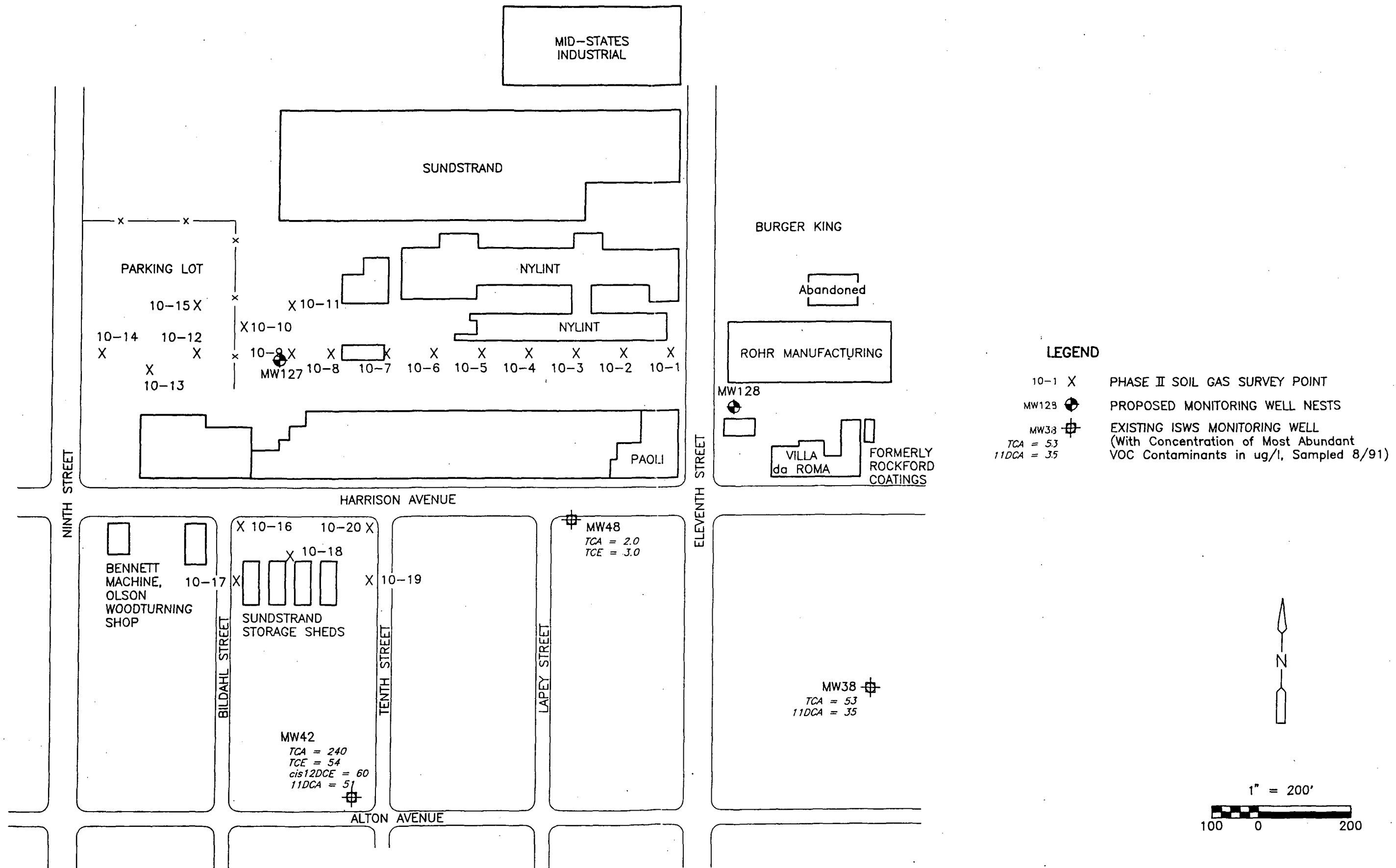
SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION STUDY
**POTENTIAL SOURCE
 AREA 5**
 Figure No. 4-6

I:\CADD\7\RI\P2SAP\ P2SAP4-6 02/22/93 G. FOSZCZ

02/22/93 G. FOSZCZ

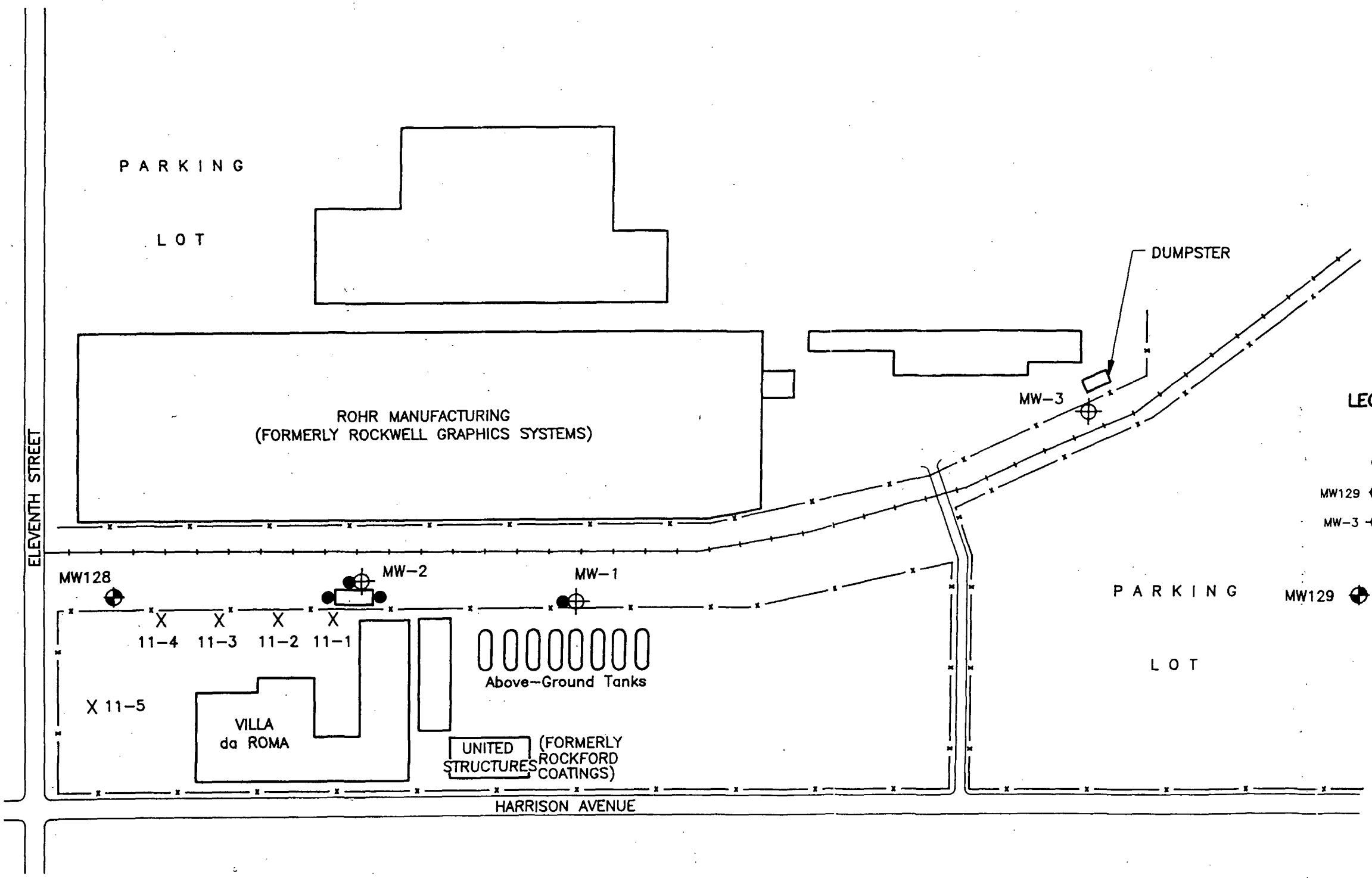
P2SAP4-8

I:\CAD\18\17\RI\P2SAP



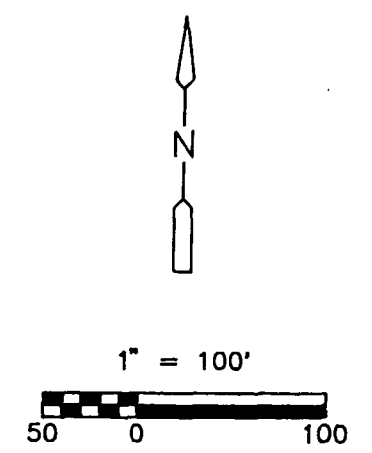
SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION STUDY
**POTENTIAL SOURCE
AREA 10**

04/26/93 G. FOSZCZ
P2SAP4-9
I:\CAD\16\7\RN\2SAP\



LEGEND

- X PHASE II SOIL GAS SURVEY POINT
- PROPOSED SOIL BORING LOCATION
- MW129 ● PROPOSED MONITORING WELL NESTS
- MW-3 ⊕ EXISTING MONITORING WELL



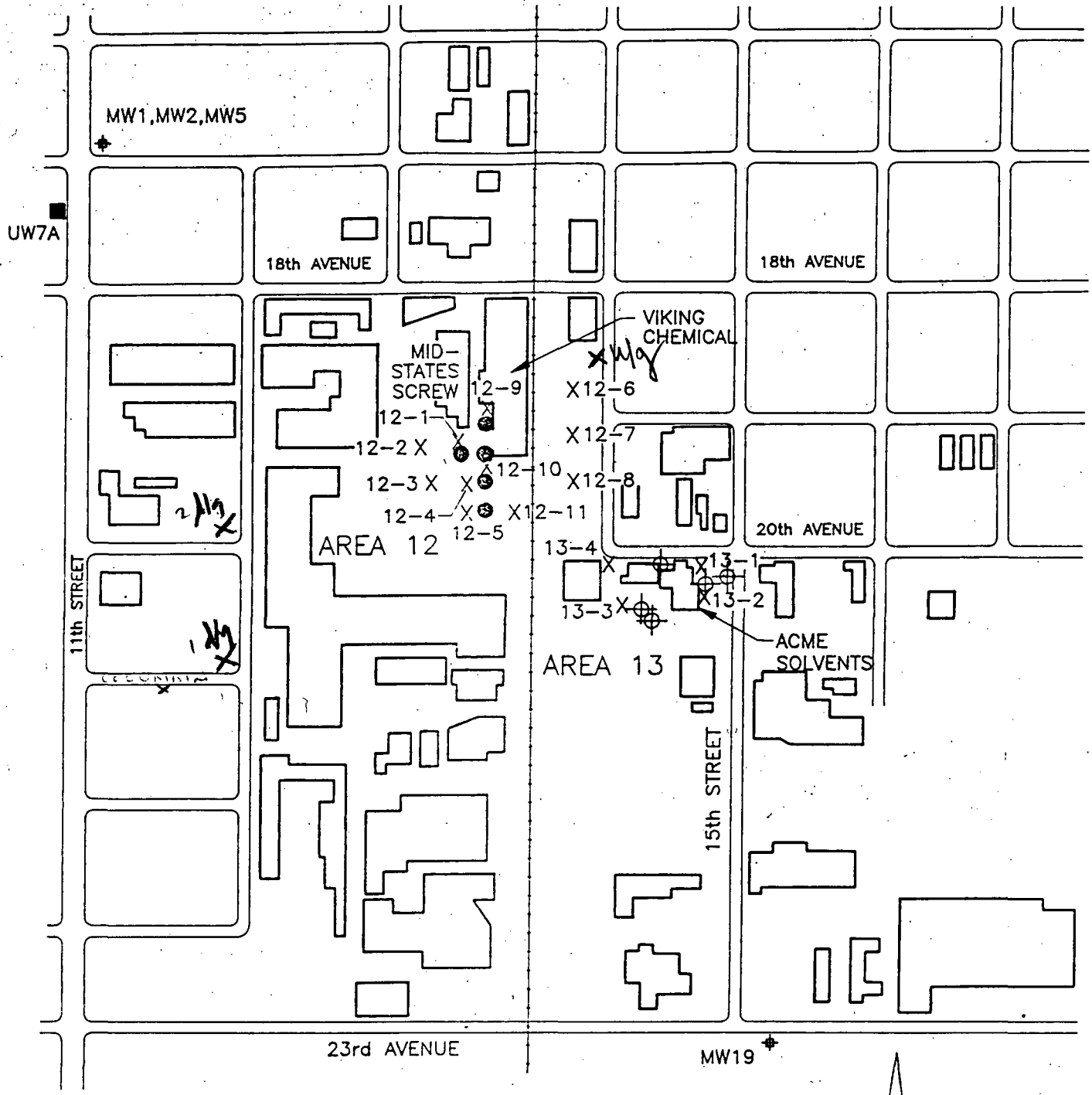
SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION STUDY
**POTENTIAL SOURCE
AREA 11**

Figure No. 4-9

02/22/93 G. FOSZCZ

25AP4-10

I:\CAD\1681\7\25AP4\



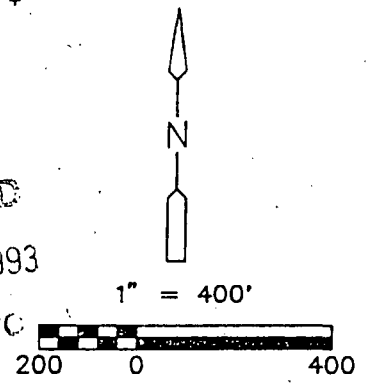
LEGEND

- X PHASE II SOIL GAS SURVEY POINT
- PROPOSED SOIL BORING LOCATION
- MW19 + EXISTING ISWS MONITORING WELL
- + EXISTING IEPA MONITORING WELL
- UW7A ■ ABANDONED MUNICIPAL WELL

RECEIVED

JUN 01 1993

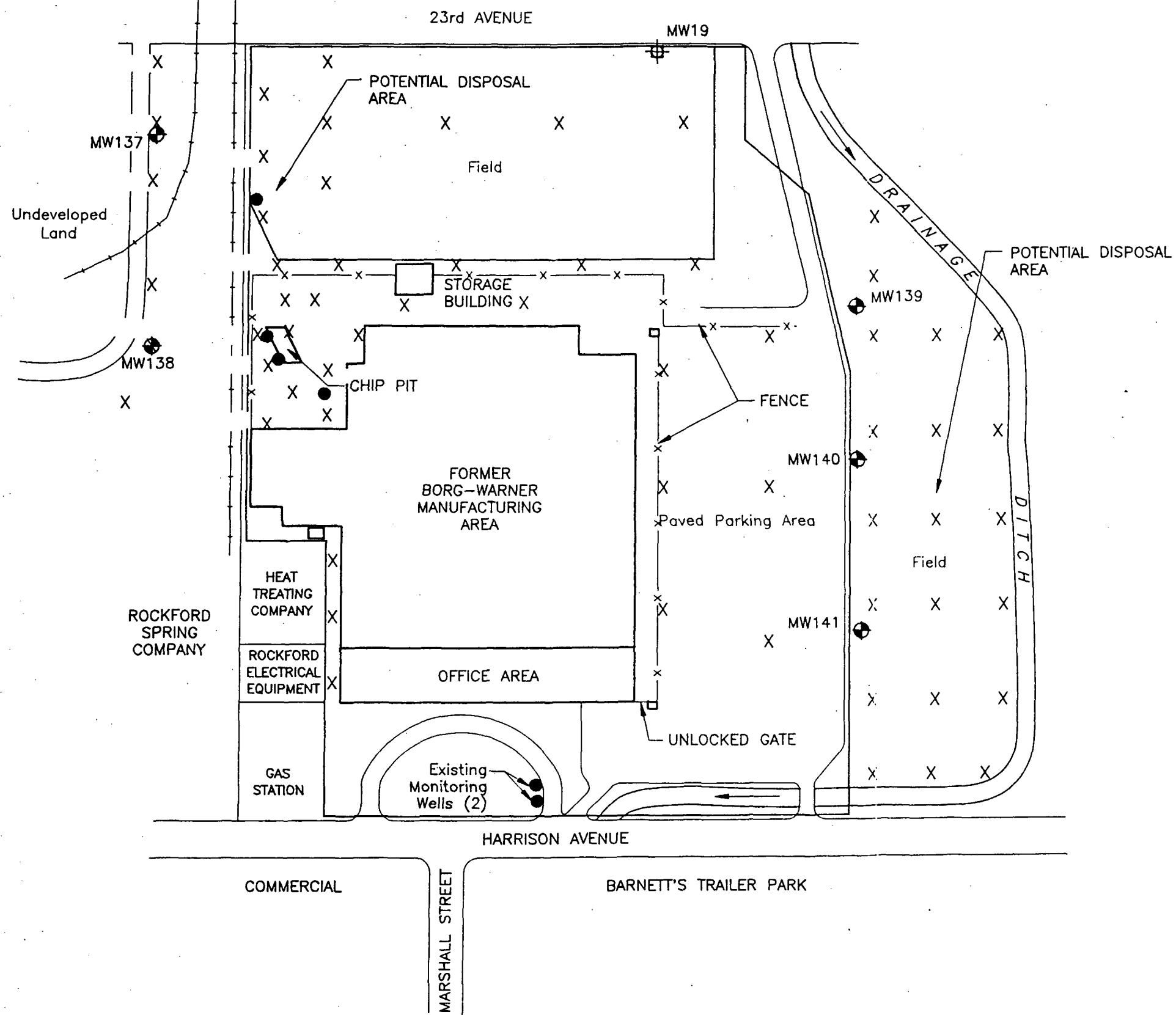
IEPA/DLPC



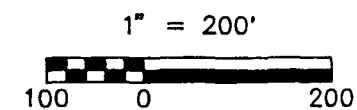
SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION STUDY
POTENTIAL SOURCE
AREA 12 AND 13

CDM
environmental engineers, scientists,
planners, & management consultants

Figure No. 4-10

CDMenvironmental engineers, scientists,
planners, & management consultants**LEGEND**

- X PHASE II SOIL GAS SURVEY POINT
- PROPOSED SOIL BORING LOCATION
- MW137 ● PROPOSED MONITORING WELL
(5 Downgradient Of Potential Disposal Areas; Upgradient Data Will Be Provided By Wells At Suntec Immediately To The East)
- MW19 ⊕ EXISTING ISWS MONITORING WELL
- PROPERTY LINE



SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION STUDY
**POTENTIAL SOURCE
 AREA 14**

To investigate the nature and extent of buried material in Area 7, Phase II field activities will include excavation and sampling of two test pits, drilling and sampling of four soil borings near the test pits, and air sampling at the perimeter of the test pits.

SOIL BORINGS

Soil borings will be drilled adjacent to each test pit in areas that geophysical data indicate no buried material. A total of four soil borings will be drilled to a depth of 15 feet using hollow-stem augers and one split-spoon sample will be collected for every two feet of auger advancement (i.e. continuous sampling), beginning at the ground surface. Level B protection will be required for all drilling and sampling personnel. Drilling personnel will monitor the breathing space and field-screen the split-spoon samples for VOCs, H₂S, and hydrogen cyanide. On-site CDM personnel will select any soil samples for laboratory analysis; such samples will be analyzed for TCL Organics and TAL Inorganics.

The primary purpose of drilling the soil borings is to check for the presence of hydrogen cyanide in the subsurface. If hydrogen cyanide is found, drilling activities will be terminated and a test pit will not be excavated in this part of Area 7. Boreholes will be backfilled with drill cuttings; for any borings where drill cuttings do not fill the entire boring, bentonite chips will be used to complete the backfilling process. The top layer of soil shall be set aside and used to cover the backfilled borehole.

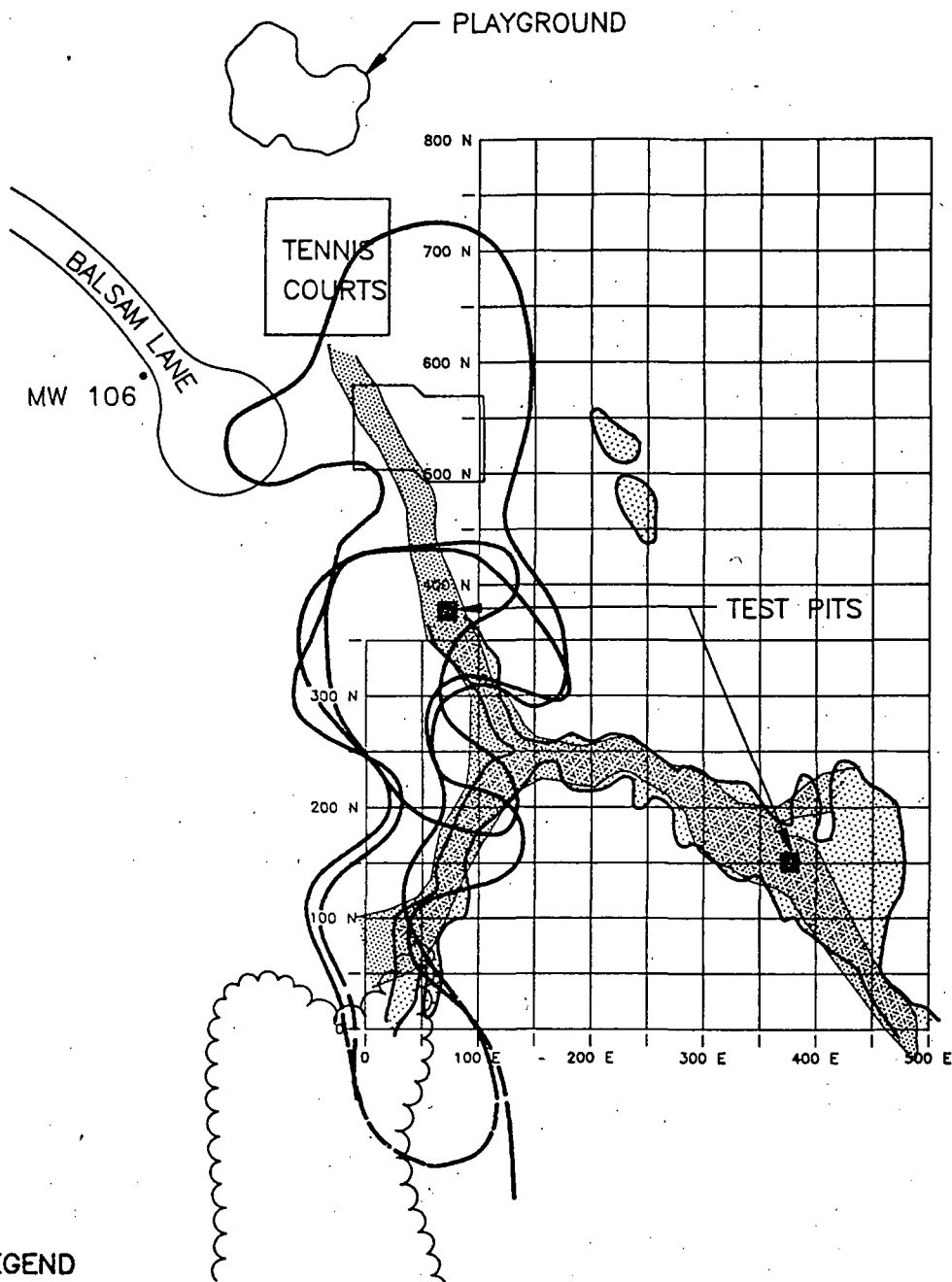
TEST PITS

Two test pits will be excavated at locations known to contain buried material. The two proposed test pit locations are shown on Figure 4-12. The location centered at 375N, 75E on the grid was selected because soil gas samples showed high VOC concentrations (greater than 1,000 µg/L) at nearby survey points. The second location, at 150N, 375E, was selected because it is in an area of low VOC concentrations (less than 40 µg/L in) in soil gas. The pits will be approximately 10 feet wide, 10 feet long, and 15 feet deep. Level B protection

LEGEND

- SOIL GAS ANOMALY
(>100 ug/l)
- EM-31 ANOMALY
- GPR ANOMALY

SCALE
50 0 100 FEET



SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION STUDY
POTENTIAL SOURCE AREA 7

PROPOSED TEST PIT LOCATIONS AND
SOIL GAS AND GEOPHYSICAL ANOMALIES

Figure No. 4-12

CDM

environmental engineers, scientists,
planners, & management consultants

will be necessary for personnel excavating and sampling the test pits. Soil samples will be collected using a backhoe bucket. Personnel shall not enter the pits at any time. To minimize the chance of puncturing buried debris, the backhoe bucket shall be toothless. In addition, the backhoe cab shall be protected with an impact-resistant windshield and/or windows. Air monitoring (VOCs, H_2S , and hydrogen cyanide) will be conducted during excavation. The pits shall be dug in a timely fashion such that an open pit is not left standing overnight. Test pits will be backfilled with the excavated soils. The top layer of soil shall be set aside and used to cover the backfilled excavation.

In order to characterize the abundance of contaminants in the test pits, soil samples will be collected from the test pits. Approximately four soil samples will be submitted for analysis from each test pit; samples will be selected for analysis based on visual and/or VOC screening using an HNu or OVM. The method of sample collection is specified in subsection 5.5. The four soil samples from each test pit will be analyzed for TCL Organics and TAL Inorganics, and two samples from each test pit will be analyzed for TCLP Organic and Inorganic parameters. Any medium- and high-concentration samples will require special containers, packaging and analysis, as discussed in subsections 3.1 and 3.3.

AIR SAMPLING

Air sampling using SKC portable sampling pumps (or equivalent) with Tenax tubes will be conducted at each pit. The SKC sampling pumps will be mounted on tripods and positioned along every side of the pits, and at various distances downwind from the pits. Sampling pumps will be calibrated prior to sampling. Approximately 10 air samples will be collected at each pit (7 downwind and 3 upwind); duplicate samples will be collected at a frequency of one for every 10 samples.

4.2 GROUNDWATER SAMPLE LOCATIONS

Groundwater samples collected during the Operable Unit and Phase I investigations have allowed: 1) lateral definition of the contaminant plume south of Harrison Avenue and west of 24th Street; 2) general lateral and vertical definition of the contaminant plume south of Harrison Avenue and east of 24th Street; 3) chemical characterization of the contaminant plume south of Harrison Avenue, particularly west of 24th Street; and 4) identification of potential contaminant sources near and south of Harrison Avenue. In order to fully evaluate the source, extent, migration and ultimate fate of groundwater contaminants in the study area, the following are the primary objectives for the Phase II hydrogeologic investigation of the Southeast Rockford site: 1) better define the lateral and vertical extent of groundwater contamination in the area south of Harrison Avenue and east of 24th Street; 2) define the vertical extent of groundwater contamination south of Harrison Avenue and west of 24th Street; 3) in the recently-added portion of the study area north of Harrison Avenue, identify potential contaminant migration pathways from identified source areas to the site; 4) evaluate potential contaminant source areas; 5) better define the geology and hydrogeology of the study area; and 6) provide data to support groundwater modeling, support a risk assessment, and support evaluation of remedial alternatives.

For convenience, proposed Phase II monitoring wells are divided into two categories based on whether they are proposed for the purpose of identifying likely contaminant sources (source investigation) or for the more general purpose of providing data on contamination, geology, and hydrogeology (groundwater investigation). Phase II monitoring wells not connected to the investigation of specific source areas are considered part of the groundwater investigation. All proposed monitoring wells will be placed in the unconsolidated deposits, the Galena-Platteville Group, or the St. Peter Sandstone. In the eastern portion of the study area (east of 20th Street), the unconsolidated deposits and the Galena-Platteville Group are the two aquifers found nearest the ground surface; in much of the area west of 20th Street the Galena-Platteville is eroded away and is replaced by the St. Peter Sandstone as the shallowest bedrock aquifer.

4.2.1 SOURCE INVESTIGATION WELLS

Table 4-1 presents the rationale behind the location of the proposed source investigation wells to be installed in Phase II; Figures 4-2 through 4-11 show the locations of these monitoring wells. In general, source investigation wells are designed to evaluate the contribution of a specific source to the groundwater contaminant plume. Such an evaluation generally involves the installation of monitoring wells upgradient and downgradient of a potential source. Up- and downgradient directions are based on groundwater elevations in existing Illinois State Water Survey monitoring wells. The ground location of source investigation wells will be a short distance upgradient (at least 100 feet upgradient, to avoid any upgradient dispersion of contaminants from the source) and a short distance downgradient of the potential source areas. Source investigation wells may be placed at greater depths at well nests MW131 and 132, in order to determine the origin of contamination at the same elevation at nearby MW101.

In general, most sources of VOC contamination result from surficial disposal of spent solvents. These liquids tend to remain in the unsaturated zone for extended periods, owing to efficient adsorption onto soil particles and slow dissipation by processes including volatilization, degradation, and dissolution into water infiltrating the soil. Consequently, source investigation wells are generally placed in the uppermost portion of the saturated zone, nearest to the unsaturated zone (the most likely depth where source contaminants reside); this will guide the depth of most source investigation wells to be installed in Phase II.

In some cases, however, a large quantity of solvent may have been disposed of, such that the solvent may have migrated downward into the saturated zone. Upon reaching the saturated zone, chlorinated solvents of the type found in the study area plume will not travel with the groundwater, owing to their low solubility in water. Though small quantities will dissolve into the groundwater, the bulk of the solvent will tend to continue to migrate downward as

TABLE 4-1

**RATIONALE FOR PHASE II MONITORING WELLS
AT SOUTHEAST ROCKFORD - SOURCE INVESTIGATION**

Well Number	Location	Number and Depth of Wells	Rationale
MW119	Fourth Street, south of Sawyer Road	One well (approx. 65 ft.)	Located upgradient of groundwater and soil gas "hits" of PCE (and potential source area 1). This well will help define the PCE source location as well as the extent of groundwater contamination in the area.
MW120	Foley Street, between Kennon and Barry Roads	One well (approx. 65 ft.)	Located downgradient of potential source area 1 and the associated groundwater hit of PCE (545 ppb of PCE). This well will help define the downgradient extent of this PCE groundwater contamination. This location is also upgradient of a TCE and cis-1,2-DCE hit in groundwater; the well will help determine the extent and origin of this TCE/cis-1,2-DCE contamination, and its possible relationship to the PCE contamination.
MW121	Olsen Street and Harrison Avenue	One well (approx. 65 ft.)	Located between a landfill and two residential wells with high concentrations of chlorinated organics (up to 1,517 ppb total VOCs). This well will help determine the relative contributions of the landfill and other potential sources in area 2 to this portion of the plume; also will assist in determining local groundwater gradients and flow directions.

TABLE 4-1

**RATIONALE FOR PHASE II MONITORING WELLS
AT SOUTHEAST ROCKFORD - SOURCE INVESTIGATION**

Well Number	Location	Number and Depth of Wells	Rationale
MW122	Kling Street and Harrison Avenue	One well (approx. 65 ft.)	Located roughly upgradient of a potential source in area 2. This well will help determine the source of the contamination farther downgradient; also will assist in determining gradients and flow directions.
MW123	South of Harrison and east of Sixth Street	One well (approx. 65 ft.)	Located downgradient of areas 3 and 9, and upgradient of ISWS well MW46, which has high contaminant concentrations of TCE (132 ppb) and PCE (109 ppb). This well will help determine the source of the contaminants in MW46, the downgradient extent of any contaminants emanating from areas 3 or 9, and also help in determining groundwater gradients and flow directions.
MW124	East of intersection of Sixth Street and Park Court	One well (approx. 85 ft.)	Located downgradient of a highly contaminated well (over 500 ppb of both TCA and 1,1-DCA) at 2647-8th Street. This well will help define the downgradient fate of the noted contaminants.
MW125	Eighth Street and Harrison Avenue	One well (approx. 42 ft.)	Located downgradient of several potential industrial source areas (areas 9, 10, and 11). This well will define the contribution of these potential sources to downgradient contamination.

TABLE 4-1

**RATIONALE FOR PHASE II MONITORING WELLS
AT SOUTHEAST ROCKFORD - SOURCE INVESTIGATION**

Well Number	Location	Number and Depth of Wells	Rationale
MW126	Eighth Street between Harrison and Alton	Two wells (approx. 55 and 85 ft.)	Located upgradient of the contaminated well at 2647-8th Street. These wells will determine whether the noted contamination derives from the facility at 2647-8th Street or an upgradient source.
MW127	East of Ninth Street and north of Harrison Avenue	One well (approx. 42 ft.)	Located downgradient of two potential industrial sources (in potential source area 10), upgradient from others (in potential source area 9), and near an elevated groundwater "hit" (MW20, which has 378 ppb of 1,1-DCE). This well will help define the relative contributions of the various potential sources.
MW128	Eleventh Street north of Harrison Avenue	One well (approx. 45 ft.)	Located in potential source area 11 approximately 200 feet downgradient of a bunker and an associated monitoring well containing elevated (1,150 ppb) TCA and other compounds, and roughly upgradient of an elevated groundwater "hit" in the main part of the plume (at MW20). This well will show whether the noted contamination has migrated downgradient from the bunker area, and whether it contributes to the contamination in the main portion of the plume.

TABLE 4-1

**RATIONALE FOR PHASE II MONITORING WELLS
AT SOUTHEAST ROCKFORD - SOURCE INVESTIGATION**

Well Number	Location	Number and Depth of Wells	Rationale
MW129	North of Harrison at Cannon Street	One well (approx. 50 ft.)	Located upgradient of the potential source noted under MW128 and near (and side-gradient to) a well that showed elevated (991 ppb) TCA in the Operable Unit phase. This well will serve as an upgradient well to evaluate the potential source noted above, will help define the extent of contamination near the Operable Unit well noted above, and will also determine the possibility of a northern source for contamination at the Operable Unit well. The well is also downgradient of a portion of area 14, and will determine the downgradient migration of contaminants from that portion of area 14.
MW130	East of Sewell, one block south of Harrison	One well (approx. 42 ft.)	Located 250 feet downgradient of a Phase I gas hit of TCA (3400 ug/l at potential source area 4). This well will test the impact of this potential source on groundwater, and determine any connection to a downgradient hit of TCA (991 ppb, sampled in Operable Unit phase).

TABLE 4-1

**RATIONALE FOR PHASE II MONITORING WELLS
AT SOUTHEAST ROCKFORD - SOURCE INVESTIGATION**

Well Number	Location	Number and Depth of Wells	Rationale
MW131 (Contingent on soil gas and soil sampling results)	One block east of 24th Street, one block south of Laude Drive	Two wells (approx. 50 and 130 ft.)	Located approximately 400 feet downgradient of the central portion of potential source area 5. This central part showed some trenching in 1958 and was at least partly devoid of vegetation between 1958 and 1970. Area 5 is also suspect because of the especially high contaminant concentrations in the deep well MW101B (12 ppm of TCA), highest of any well sampled thus far. These wells will be located approximately 700 feet upgradient of MW101, and will allow determination of the contribution of area 5 to the contaminant plume.
MW132 (Contingent on soil gas and soil sampling results)	One block east of 24th Street, about two blocks south of Laude Drive	Two wells (approx. 60 and 130 ft.)	Located approximately 400 feet downgradient of the southern part of potential source area 5. This southern portion showed evidence of extensive trenching in 1958, and the area was at least partly devoid of vegetation between 1958 and 1988. MW132 will also be located roughly upgradient of high contaminant concentrations found in wells surrounding 24th and Reed (sampled during the Operable Unit). The MW140 wells will therefore allow determination of the contribution of the southern part of area 5 to the contaminant plume.

TABLE 4-1

**RATIONALE FOR PHASE II MONITORING WELLS
AT SOUTHEAST ROCKFORD - SOURCE INVESTIGATION**

Well Number	Location	Number and Depth of Wells	Rationale
MW133	Approximately 500 to 1,000 feet east of potential source area 5	Three wells (approx. 40, 80 and 110 ft.)	Located upgradient of potential source area 5. Combined with MW131 and 132, these wells will allow determination of whether the main plume's contamination originates solely from the area upgradient of MW106, or if additional contamination is contributed by area 5.
MW134	Between MW105 and MW106	Two wells (approx. 30 and 75 ft.)	Located roughly midway between MW105 and MW106, downgradient of the northern part of potential source area 7. These wells will allow characterization of the northern portion of the contaminant plume in this area.
MW135	Approximately 500 feet south of MW106	One well (approx. 60 ft.)	Located side-gradient to MW106 and south of the southernmost suspected source areas in area 7. This well is designed to better define the southern edge of the contaminant plume in this area.
MW136	At west end of O'Connell, or north of O'Connell and 1 block west of Alpine Road	Three wells (approx. 30, 70 and 105 ft.)	Located upgradient of any potential sources in area 7. These wells will determine whether contaminants exist upgradient of area 7, thereby defining area 7's contribution to the contaminant plume.

TABLE 4-1

**RATIONALE FOR PHASE II MONITORING WELLS
AT SOUTHEAST ROCKFORD - SOURCE INVESTIGATION**

Well Number	Location	Number and Depth of Wells	Rationale
MW137 (Contingent on soil gas and soil sampling results)	South of 23rd Avenue, one block west of 15th Street	One well (approx. 42 ft.)	Located immediately downgradient of an alleged disposal area at Borg-Warner (potential source area 14). This well will serve to detect any impact of this disposal area on the groundwater.
MW138 (Contingent on soil gas and soil sampling results)	South of MW137	One well (approx. 42 ft.)	Located immediately downgradient of a pit (possibly unlined) used for disposal of metal chips and that has shown ppm-level soil concentrations of several chlorinated organic compounds. This well will allow detection of any impact of this pit on downgradient groundwater.
MW139 (Contingent on soil gas and soil sampling results)	South of 23rd Avenue near 15th Street	One well (approx. 42 ft.)	Located downgradient of northern portion of undeveloped land that may have been used for disposal of hazardous materials, the well will define any impact on downgradient groundwater. Wells serving as upgradient control for this area will be the existing wells located on Suntec property just east of Borg-Warner.

TABLE 4-1**RATIONALE FOR PHASE II MONITORING WELLS
AT SOUTHEAST ROCKFORD - SOURCE INVESTIGATION**

Well Number	Location	Number and Depth of Wells	Rationale
MW140 (Contingent on soil gas and soil sampling results)	South of MW139	One well (approx. 42 ft.)	Same as MW139, but will test central portion of the potential disposal area.
MW141 (Contingent on soil gas and soil sampling results)	South of MW140	One well (approx. 42 ft.)	Same as MW139, but will test southern portion of the potential disposal area.

immiscible liquid phases under the influence of gravity (owing the high density of chlorinated solvents); hence they are commonly referred to as DNAPLs, or dense non-aqueous phase liquids. If enough solvents are disposed of, they will continue to migrate downward until they reach a low-permeability layer. Under such conditions, significant volumes of contaminants could migrate far below the ground surface. At such locations they will dissipate slowly; dissolving slowly into adjacent groundwater, they will act as ongoing sources of contamination to groundwater. Such a scenario (DNAPLs present at depth below the ground surface) may possibly account for the elevated contaminant concentrations present at depth in monitoring well nest MW101. In order to evaluate the possibility of DNAPLs present at considerable depth below ground surface, groundwater samples may be collected during drilling of certain groundwater investigation wells, such as MW131 and 132. Located just downgradient of soil gas survey area 5, the collection of groundwater samples during drilling of these wells will be contingent on field indications. Such indications include the results of the soil gas survey in area 5, as well as any evidence of contamination in the subsurface soil samples collected at the location.

Groundwater samples will also be collected during drilling at source investigation wells MW119 through MW124. The rationale behind collecting these samples is that the depths to elevated contaminant concentrations are unknown near these wells in the western portion of the study area. Groundwater is known to be contaminated in this area, but the wells containing these contaminants are screened at unknown depths. Collecting groundwater samples during drilling will accomplish the objective of evaluating potential source areas, as well as determining the proper depth for screening the new monitoring well for plume characterization purposes. Specific details on the depths and number of groundwater samples to be collected during drilling are given in subsection 5.3 and Table 5-2.

4.2.2 GROUNDWATER INVESTIGATION WELLS

Table 4-2 presents the rationale behind the location of proposed groundwater investigation wells to be installed in Phase II; Figure 4-13 shows the locations of these monitoring wells.

TABLE 4-2

**RATIONALE FOR PHASE II MONITORING WELLS
LOCATIONS - GROUNDWATER INVESTIGATION**

Well Number	Location	Number and Depth of Wells	Rationale
MW101C	Existing well nest MW101	One well at approx. 172 ft.	Install intermediate-depth well (existing wells are at 88, 151 and 202 feet) to characterize bedrock contaminant plume at a location exhibiting the highest TCA concentrations (12,000 ppb in MW101B) observed in Phase I groundwater samples.
MW109D	Existing well nest MW109	One well at approx. 45 ft.	Install a well in known interval of high permeability at top of bedrock. This well will help to assess the effect of such a zone on the migration of contaminants.
MW112	North of potential source area 7, just south of creek, and 900 feet ESE of MW105	Three wells at approx. 57, 135, and 350 ft.	Located between the two large areas of groundwater contamination defined in Phase I, the four upper wells will allow determination of whether the two contaminated areas are connected. The deep well of this nest will be installed in the St. Peter Sandstone, in order to provide a measure of hydraulic head in this aquifer in the eastern part of the study area.
MW113	Near ISWS well MW28	Two wells at approx. 150 and 230 ft.	Evaluate vertical extent of contaminant plume below screened depth of ISWS wells MW28 and MW18. Lower boundary of the contaminant plume is unknown in this area.

TABLE 4-2**RATIONALE FOR PHASE II MONITORING WELLS
LOCATIONS - GROUNDWATER INVESTIGATION**

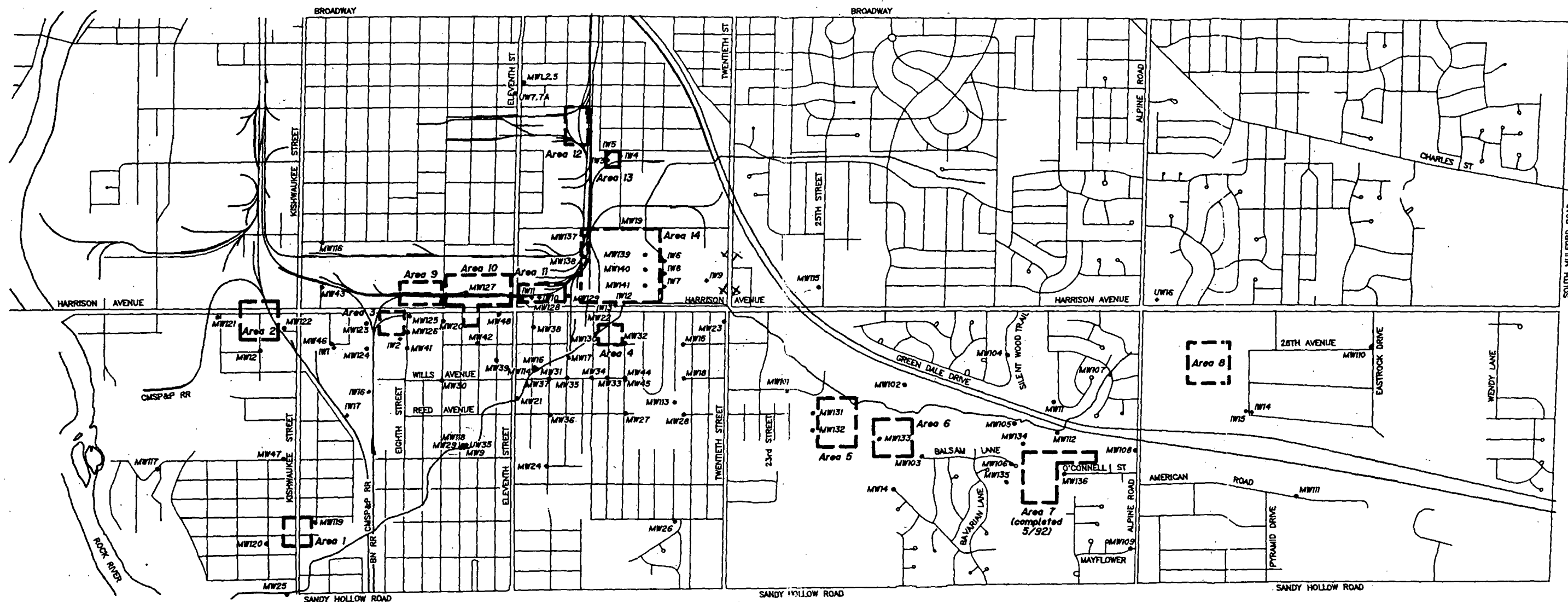
Well Number	Location	Number and Depth of Wells	Rationale
MW114	Existing ISWS wells MW16 and MW31	Two wells at approx. 150 and 230 ft.	Evaluate vertical extent of contaminant plume below screened depth of MW16 and MW31. Lower boundary of contaminant plume is unknown in the western part of this plume.
MW115	On 25th Street north of Harrison Avenue	Two wells at approx. 70 and 115 ft.	Determine whether contamination exists in unknown (potentially background) area upgradient of known contamination. Provide geologic and hydrogeologic data for groundwater modelling. Serve as potential background location.
MW116	23rd Avenue and 4th Street	Two wells at approx. 80 and 170 ft.	Determine contaminant concentration near northwest extent of known contaminated area. Provide geologic and hydrogeologic data for groundwater modelling.
MW117	Near Rock River at Chapman and Brooke Roads	Three wells at approx. 40, 90, and 160 ft.	Determine vertical extent of contamination near downgradient extent of contaminant plume. Determine potential contaminant inputs to the Rock River. Evaluate vertical hydraulic gradients.

TABLE 4-2

**RATIONALE FOR PHASE II MONITORING WELLS
LOCATIONS - GROUNDWATER INVESTIGATION**

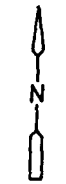
Well Number	Location	Number and Depth of Wells	Rationale
MW118	Existing ISWS wells MW9 and 29, and municipal well UW35	One well at approx. 110 ft.	Provide contaminant monitoring point at depth not currently monitored. At this location, pumping of UW35 before its shutoff drew in contamination; the resumption of pumping at UW35 may draw in contaminants again.

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LEGEND:

- MW11 EXISTING ISWS MONITORING WELL
- MW101 EXISTING (MW101 THROUGH MW111) AND PROPOSED (MW112 THROUGH MW141) CDM WELL NESTS
- IW14 EXISTING ON-SITE INDUSTRIAL SUPPLY WELL OR MONITORING WELL
- MW16 EXISTING OR ABANDONED MUNICIPAL SUPPLY WELL
- PROPOSED PHASE II SOIL GAS SURVEY AREA
(NOTE: SOIL GAS WORK WILL NOT BE CONDUCTED IN AREA 6 OR AREA 8.)



SCALE:
500 0 1000 Feet

SOUTHEAST ROCKFORD GROUNDWATER CONTAMINATION STUDY
EXISTING AND PROPOSED MONITORING WELLS
AND PHASE II PROPOSED SOIL GAS SURVEY AREAS

Phase II groundwater investigation wells are MW112 through MW118, with additional wells installed at Phase I well nests MW101, and 109. Two additional wells (MW101D and MW103D) were installed by the U.S. Geological Survey during October 1992 to February 1993. These activities were overseen by CDM and the wells are considered groundwater investigation wells. In general, proposed monitoring well locations for the Phase II groundwater investigation are designed to fill in the gaps where contaminant concentrations, geology, and hydrogeology are poorly known. Existing well coverage is sparse in the portions of the study area south of Harrison Avenue and east of 24th Street, as well as the area north of Harrison that was recently added to the study area. In the latter area, few residential wells have existed, and the few that did have now been connected to municipal water supplies. As a result, a primary goal of installing wells in this northern area is to evaluate the potential for contaminants to migrate from identified source areas to the site.

East of 24th Street and south of Harrison Avenue, the main contaminant plume shows relatively high contaminant concentrations (greater than 1,000 ppb of TCA) , but the outlines and source(s) of contamination are not well defined. Most of the source identification task will be accomplished by the soil gas, soil boring, and test pit work described in subsection 4.1; however, new monitoring wells and groundwater samples are necessary to verify the source identifications indicated through the soil gas and soil boring work.

West of 24th Street and south of Harrison Avenue, approximately 40 Illinois State Water Survey wells provide effective geographic coverage of the plume, but the vertical extent of the plume is unknown. At MW101 near 24th Street, contaminant concentrations increase rapidly with depth. Deep well MW101B contained 12 ppm of TCA in Phase I while shallow well MW101A contained only 710 ppb of TCA. West of this location, however, there are no monitoring wells as deep as MW101B (screened from 141 to 151 feet), and the pattern of contamination with depth is unknown. The maximum depth of contamination is of concern for several reasons: 1) municipal Unit Well 35 is screened at 150 to 210 feet, a depth much greater than existing monitoring wells, and the recent resumption of pumping there will probably again draw in contaminants (both laterally and downward); 2) several other

municipal wells in the study area are set in deeper bedrock aquifers; and 3) the vertical pattern of contamination is important to define for the purposes of aquifer cleanup. As a result, west of 24th Street the new monitoring wells will be installed largely to define vertical contaminant patterns, with most new wells being installed at greater depths than existing wells.

Though the source investigation and groundwater investigation are discussed separately here, it should be noted that the functions of the two investigations are related to some extent. For instance, the monitoring wells under the source investigation will also be useful for the groundwater investigation in defining geologic and hydrogeologic conditions at various locations. In a similar manner, wells installed under the groundwater investigation can be useful for the source investigation, because observed contaminant pathways and fingerprints can generally be related to specific sources of contamination. In order to provide information on the local geology and groundwater flow, wells will be screened at various depths within a well nest to allow an evaluation of vertical hydraulic gradients and interconnectivity of aquifers. Water levels at the various well nest locations across the site will allow lateral definition of the water table surface and quantitative evaluation of hydraulic gradients and contaminant transport directions. The number of wells in each nest will depend on depth to the water table, depths of any existing wells at the location, the presence of clay or silt layers which may act as aquitards, and the results of groundwater samples collected during drilling for screening purposes (discussed in the following paragraph). Generally, wells in each nest will be screened at intervals of approximately 50 feet (base of screen to base of screen) within each aquifer, or between aquitards, if present. The distribution of well screens at a single well nest is intended to allow an analysis of the vertical distribution of contaminants among aquifers and within each aquifer. Well screen placement will be determined in the field, based on the hydrogeologist's evaluation of the subsurface units as represented by the subsurface soil samples, and where collected, the results of groundwater samples collected during drilling for screening purposes.

12 acres



dingen!

pres

RESIDENTIAL AIR SAMPLING GROUPS

*environmental engineers, scientists,
planners, & management consultants*

Figure No. 4-14

as polyvinyl chloride products, may interfere with analytical results. Therefore, specific indoor sampling locations will be determined following inspection of the basement.

However, samples will generally be located in living space areas that would have the highest exposure potential.

A minimum of two background residences will be selected for air quality sampling to determine in-home background levels of volatile organics. These residences will be selected such that influences from site contaminants (chlorinated volatile organics) are not expected. The procedure to collect background samples will be the same as described above for the other residential air samples.

4.3.2 AMBIENT AIR SAMPLING

An ambient air sample from outside each residence will be collected simultaneously with the indoor air sample to determine the VOC concentrations immediately outside the residence.

As described above, both the ambient air and indoor air samples will be collected over a 24-hour period with a 15-liter Summa canister.

5.0 SAMPLING EQUIPMENT AND PROCEDURES

5.1 DRILLING PROCEDURES AND EQUIPMENT

Hollow-stem augers will be used to drill as many boreholes as is technically and economically feasible. When this drilling method becomes impracticable due to presence of heaving sands or due to difficult drilling because of great depth (greater than about 175 feet), boreholes will be drilled using the mud-rotary method. This method is expected to be required for wells installed in the western portion of the study area where depth to bedrock is at least 200 feet. At locations where drilling will continue into the bedrock, the bedrock portion of the borehole will be drilled using the air-rotary drilling method. The approximate anticipated depths and the drilling methods required for each well are listed in Table 5-1, and a schematic diagram of the well installations are shown on Figure 5-1. All boreholes will be drilled with a minimum diameter of 6 inches, in order to allow an annular space of 2 inches between the 2-inch I.D. Type 304 stainless steel riser pipe and the wall of the boreholes. Analytical, geotechnical and lithologic soil samples will be collected from the deepest boreholes in each well nest as discussed in subsection 5.5 unless sampling from a more shallow borehole would expedite the field effort.

For wells installed in the bedrock (approximately 8 wells; see Table 5-1), a 6-inch (inside-diameter) outer casing will be installed from the ground surface to the top of bedrock, in order to minimize interaquifer flow within the borehole. Such locations will require the borehole diameter to be approximately 8 inches within the unconsolidated units and in the top several feet of the bedrock, in order to admit the 6-inch casing. When bedrock is reached at these locations, the 6-inch casing will be installed and the annular space sealed with a cement-bentonite grout. Drilling into the bedrock will then proceed by air-rotary methods. Small amounts of water may be added to the air in order to facilitate lifting the cutting out of the borehole. No other fluids will be permitted, unless drilling proves ineffective without such fluids.

TABLE 5-1

PHASE II MONITORING WELL INSTALLATION SUMMARY

Well Nest Number	Approximate Well Depths (ft.) and Aquifers ¹	Screen Length (ft.)	Approximate Depth to Bedrock (ft.)	Drilling Methods and Depths (ft.)	Casing Size and Depth ²
MW101	C: 172 (GP)	10	134	C: mud-rotary (0-135); air-rotary (135-205)	C: 6-inch to 135 ft.
MW109	D: 45 (U/GP)	10	40	D: casing-driver	
MW112	A: 57 (U) B: 135 (U/GP) C: 350 (StP)	10 10 10	132	A: hollow-stem auger B: casing-driver C: mud-rotary (0-135); air-rotary (135-350)	C: 10-inch to 135 ft.; 6-inch to 310 ft.
MW113	A: 150 (U) B: 230 (GP or StP)	10 10	215	A: hollow-stem auger B: mud-rotary (0-215); air-rotary (215-250)	B: 6-inch to 215 ft.
MW114	A: 150 (U) B: 230 (StP)	10 10	215	A: hollow-stem auger B: mud-rotary (0-215); air-rotary (215-250)	B: 6-inch to 215 ft.
MW115	A: 70 (U) B: 115 (GP)	10 10	100	A: hollow-stem auger B: mud-rotary (0-100); air-rotary (100-115)	B: 6-inch to 100 ft.
MW116	A: 80 (U) B: 170 (U)	10 10	> 170	A: hollow-stem auger B: hollow-stem auger or mud rotary	
MW117	A: 40 (U) B: 90 (U) C: 160 (U)	10 10 10	> 160	A: hollow-stem auger B: hollow-stem auger C: hollow-stem auger or mud-rotary	

¹U indicates unconsolidated aquifer, GP indicates Galena-Platteville Groups and StP indicates St. Peter Sandstone.

²Casing listed here does not include the 2-inch well pipe, which will be installed in all wells.

(continued)

TABLE 5-1

PHASE II MONITORING WELL INSTALLATION SUMMARY

Well Nest Number	Approximate Well Depths (ft.) and Aquifers	Screen Length (ft.)	Approximate Depth to Bedrock (ft.)	Drilling Methods and Depths (ft.)	Casing Size and Depth ²
MW118	A: 110 (U)	10	215	A: hollow-stem auger	
MW119	A: 65 (U)	10	200	A: hollow-stem auger	
MW120	A: 65 (U)	10	200	A: hollow-stem auger	
MW121	A: 65 (U)	10	200	A: hollow-stem auger	
MW122	A: 65 (U)	10	200	A: hollow-stem auger	
MW123	A: 65 (U)	10	200	A: hollow-stem auger	
MW124	A: 85 (U)	10	200	A: hollow-stem auger	
MW125	A: 42 (U)	10	200	A: hollow-stem auger	
MW126	A: 55 (U) B: 85 (U)	5 5	200	A: hollow-stem auger B: hollow-stem auger	
MW127	A: 42 (U)	5	200	A: hollow-stem auger	
MW128	A: 45 (U)	5	200	A: hollow-stem auger	
MW129	A: 50 (U)	5	200	A: hollow-stem auger	
MW130	A: 42 (U)	5	200	A: hollow-stem auger	
MW131	A: 50 (U) B: 130 (GP)	10 10	110	A: hollow-stem auger B: mud-rotary (0-110); air-rotary (110-130)	B: 6-inch to 110 ft.

¹U indicates unconsolidated aquifer, GP indicates Galena-Platteville Groups and StP indicates St. Peter Sandstone.

²Casing listed here does not include the 2-inch well pipe, which will be installed in all wells.

(continued)

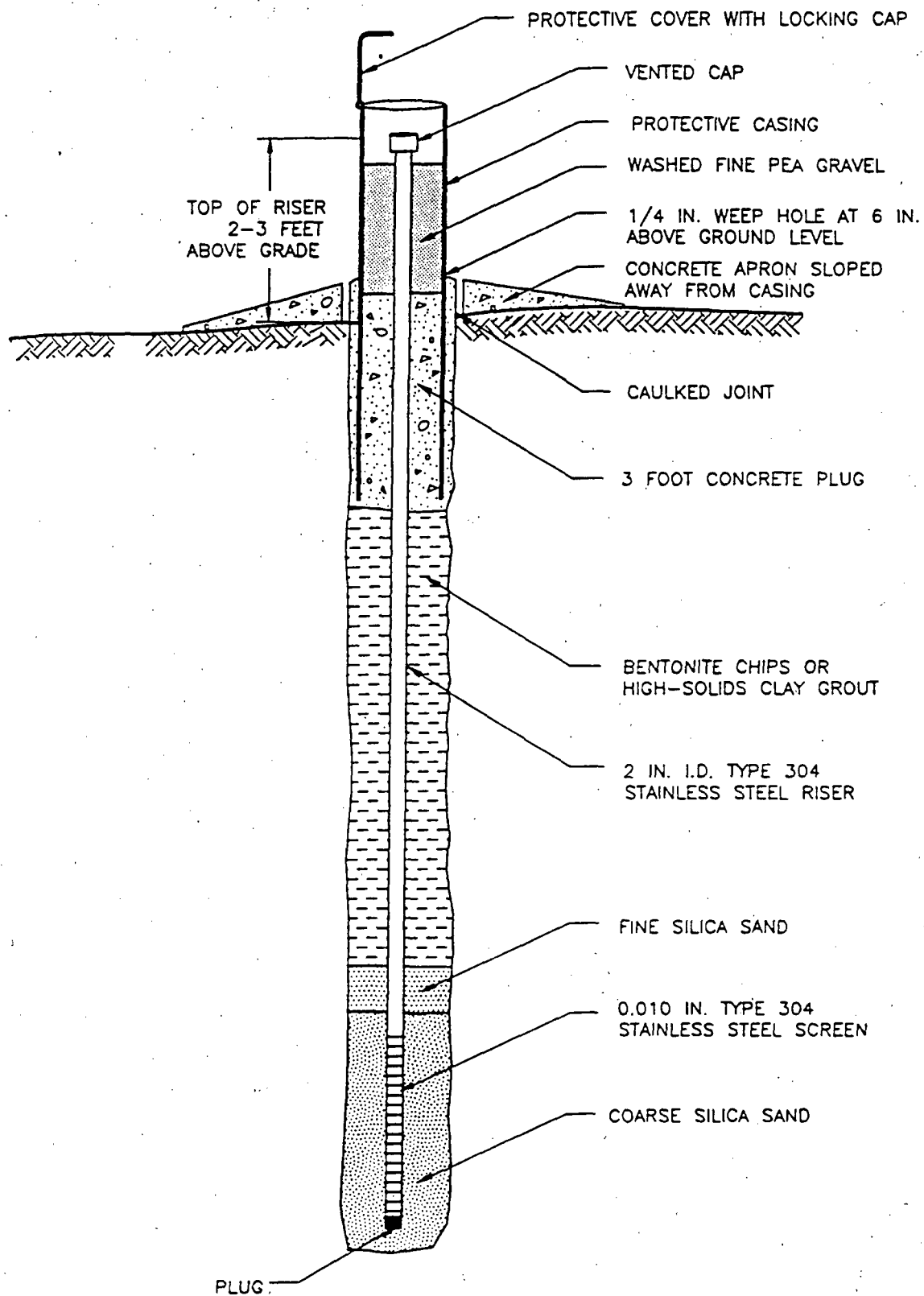
TABLE 5-1

PHASE II MONITORING WELL INSTALLATION SUMMARY

Well Nest Number	Approximate Well Depths (ft.) and Aquifers	Screen Length (ft.)	Approximate Depth to Bedrock (ft.)	Drilling Methods and Depths (ft.)	Casing Size and Depth ²
MW132	A: 60 (U) B: 130 (GP)	10 10	110	A: hollow-stem auger B: mud-rotary (0-110); air-rotary (110-130)	B: 6-inch to 110 ft.
MW133	A: 40 (U) B: 80 (U) C: 110 (GP)	10 10 10	100	A: hollow-stem auger B: hollow-stem auger C: mud-rotary (0-90); air-rotary (90-120)	C: 6-inch to 90 ft.
MW134	A: 30 (U) B: 75 (U)	5 5	95	A: hollow-stem auger B: hollow-stem auger	
MW135	A: 60 (U)	5	70	A: hollow-stem auger	
MW136	A: 30 (U) B: 70 (U) C: 105 (GP)	5 5 5	85	A: hollow-stem auger B: hollow-stem auger C: mud-rotary (0-85); air-rotary (85-105)	C: 6-inch to 85 ft.
MW137	A: 42 (U)	5	200	A: hollow-stem auger	
MW138	A: 42 (U)	5	200	A: hollow-stem auger	
MW139	A: 42 (U)	5	200	A: hollow-stem auger	
MW140	A: 42 (U)	5	200	A: hollow-stem auger	
MW141	A: 42 (U)	5	200	A: hollow-stem auger	

¹U indicates unconsolidated aquifer, GP indicates Galena-Platteville Groups and StP indicates St. Peter Sandstone.

²Casing listed here does not include the 2-inch well pipe, which will be installed in all wells.



SOUTHEAST ROCKFORD

SCHEMATIC WELL CONSTRUCTION DIAGRAM FOR MONITORING WELL

Figure No. 5-1

CDM

environmental engineers, scientists,
planners, & management consultants

At well MW112C, a well will be installed in the St. Peter Sandstone. At this location, both the unconsolidated and Galena-Platteville aquifers are expected to be present. As a result, double casing will be required to minimize flow between any of the three aquifers. A 10-inch casing will be installed from the surface to the top of the Galena-Platteville, and a 6-inch casing will be installed from the surface to the top of the St. Peter at approximately 310 feet. This will require a borehole diameter of approximately 12 inches in the unconsolidated units and approximately 8 inches in the Galena-Platteville. After installing each casing, the annular space will be sealed with a high-solids bentonite grout.

All soil boring activities are anticipated to occur in Level D personal protection. In the event that elevated organic vapor readings are detected by air monitoring instruments (HNU or OVA), personal protection levels may be upgraded. Personal protection levels and air monitoring are discussed in detail in Sections 9 and 8, respectively, of the Health and Safety Plan.

5.2 AIR SAMPLING AND ANALYSIS

5.2.1 RESIDENTIAL AIR SAMPLING

Access to residences for ambient and indoor air samples will be obtained through the IEPA Community Relations Department. In the selected area for residential air sampling, 14 residences will be sampled. As shown on Figure 4-14, 12 clusters of approximately five homes each have been selected within the plume area and near contaminant source areas. Two additional background residences will be selected in an area where groundwater contamination is known to be negligible. The IEPA Community Relations team will select one residence from each cluster, based on their capabilities to obtain permission from residents; residences will also be selected on the basis of the absence of compounds that could cause interference with sample results.

For each of the residential locations selected, two air samples will be collected, one from the breathing zone in the basement and one of ambient air collected adjacent to the residence. The samples will be collected over a 24-hour period using a Summa canister. One of the objectives of the air quality survey is to determine if residents may be exposed to VOCs from either the soil gas pathway or from ambient air influx from outdoors to indoors. The field procedures and sample collection methods are described in the following paragraphs.

Ambient Air Samples

Ambient air samples will be collected during a 24-hour period utilizing 15-liter stainless steel Summa canisters. Sampling will not occur during a rainstorm. The canisters will be located away from any obstructions by two times the height of the obstruction and with unrestricted air flow around a 270-degree arc. Canisters will be chained and locked to a metal stake to be placed at each sampling location.

The procedures for sample collection are as follows:

- Laboratory will provide canisters with critical orifice valves that allow the proper sampling rates for collection over 24-hour period;
- Connect the pressure gauge to the sample canister, open the valve, check and record initial vacuum, close valve, remove pressure gauge;
- Attach an appropriate length of teflon tubing to the sample canister;
- Connect or position the opposite end of the tubing in such a way as to access the sampling area;
- Open the valve following the laboratory instructions and initiate integrated sampling;

- Place a chain-of-custody seal over the canister valve as an indicator of tampering;
- After the 24-hour sampling period, close the valve, record the final pressure with an external pressure gauge, disconnect the tubing, and attach label to the sample canister with the pertinent sample identification.

Canisters and critical orifice valves are decontaminated by the laboratory through a process of repeatedly heating the canister and then flushing it with nitrogen; then the critical orifice valve is decontaminated in a high-temperature oven.

Indoor Air Samples

Indoor air samples will also be collected using the method described for ambient air sampling. However, the indoor air samples will be located in the basement of the selected residences. To determine whether VOCs from soil gas or ambient air are exposing individuals, the concentration of the contaminants need to be determined at the point of exposure, the breathing zone. Sources of volatile organics within the residence that are independent of subsurface contamination, such as polyvinyl chloride products, may interfere with analytical results. Therefore, specific indoor sampling locations will be determined following inspection of the basement. However, samples will generally be located in living space areas that would have the highest exposure potential. The sample canister will be placed at the height of the breathing zone and will be secured utilizing existing structures in the basement or through other mechanical devices. The location of the container in the basement should not be near open cans of paint or other types of containers that may influence the sample.

Background Air Sampling

A minimum of two homes will be selected by the IEPA Community Relations Team for the purpose of collecting background indoor air samples. The sampling procedures will be the same for the other indoor air samples. The samples will be collected at residences that are not within the contaminant plume area. Background ambient air samples will be collected simultaneously at each of these residences utilizing the sample procedures described above.

Sample Analysis, Preservation and Holding Times

The air samples will be analyzed by EPA Method TO-14 for volatile organic compounds. Air samples collected in Summa canisters do not require preservation and the analytical holding time is 30 days.

Sample Shipment

All samples collected at the site are considered environmental samples and are not known to contain hazardous levels of contaminants and may be shipped to the laboratory accordingly.

Each of the sample containers will be sealed and labeled as follows: container labels will list all required information including sample number, time, and date of collection, analysis requested, and sampler's name. The boxes will be packed with padded material. All sample documents will be affixed to the underside of each shipment box.

The shipment containers will be labeled for shipment according to EPA and Department of Transportation procedures. No precautionary notices are required on the package exterior. Shipments to the laboratory will be handled by an overnight carrier such as Federal Express. Other "cargo only" aircraft may be used but samples will not be transported by CDM personnel in private vehicles.

Sample Report Forms and Chain-of-Custody Records

Chain-of-custody procedures will be used to document the handling and processing of all samples from the time of collection until they are destroyed. Each shipment of samples will be accompanied by a CDM chain-of-custody record which documents all aspects concerning the time of collection, method of shipment, analysis requested, etc. for each sample. This written record may become important if the results of any analysis are used in litigation.

The following is a summary of the chain-of-custody procedures:

- Individuals receiving the samples shall sign, date, and note the time that they received the samples on the form matrix.
- Chain-of-custody records initiated in the field shall be placed in a plastic bag and taped to the inside of the shipping container used for sampler transport from the field to the laboratory.
- Custody seals shall be used when samples are shipped to the laboratory.
- When samples are relinquished to a shipping company for transport, the tracking number of the shipping bill/receipt shall be recorded on the chain-of-custody form.

Quality Control Measures

Duplicate, blank, and lab QC samples will be prepared in accordance with the procedures in the QAPP and will be used as a check of laboratory and field sampling procedures.

Duplicates of field samples will be collected at a frequency of 10 percent at sampling points which are known or suspected to be contaminated. Duplicates will be collected, numbered, packaged, and sealed in the same manner as the other samples. The samples will not be

identified as duplicates on the sample labels so that the identity of the sample as a duplicate will be unknown to the laboratory personnel performing the analyses. The samples will be recorded as a duplicate in the field logbook for documentation and verification purposes.

Laboratory QA/QC samples are collected to provide the laboratory extra sample volume to perform laboratory QC checks. Lab QC samples will be collected at a frequency of 1 in 20, and will be collected at locations of suspected contamination. Lab QC samples are identified on the sample labels and the chain-of-custody forms.

Blanks are used to determine if field measurements are affected by contamination due to improper cleaning techniques or carry-over contamination from previous samples. Field blanks for Summa canisters will be prepared on-site by passing ultra high purity nitrogen through the critical orifice. Blanks will be prepared at a frequency of one per day and will be sent blind to the laboratory.

5.2.2 AIR SAMPLING AT TEST PITS

Air sampling will be conducted at the two test pits to be excavated in Area 7, using SKC portable sampling pumps (or equivalent) with Tenax tubes. The SKC sampling pumps will be mounted on tripods and positioned along each side of each pit, and at various distances downwind from each pit. Sampling pumps will be calibrated prior to sampling.

Approximately 10 air samples will be collected at each pit (approximately seven downwind and three upwind). Downwind samples will be collected at various distances from the test pits. Duplicate samples will be collected at a frequency of one per 10 samples. The specific sampling procedure for the air samples collected from near the test pits is detailed in "Atmospheric Sampling for Volatile Organic Compounds" in Appendix B of this document. The samples will be analyzed by EPA method TO1, which is specified in the SAS Request Forms found in Appendix B of the QAPP.

5.3 VERTICAL PROFILING GROUNDWATER SAMPLES COLLECTED DURING DRILLING

In order to determine the optimal depth interval at which to set the monitoring well screen, vertical profiling groundwater samples will be collected at 10-foot intervals during drilling at selected monitoring well locations (in both source and groundwater investigations). These samples will be submitted to a local laboratory subcontracted to CDM for 24-hour GC analysis of halogenated VOCs. The number and depths of groundwater samples collected during drilling are given in Table 5-2.

Upon receipt of the analytical results, the field geologist will determine the depth interval at which the monitoring well screen will be set. The depth interval will generally be centered on the depth of the sample with the highest contaminant concentrations reported for the particular drilling location. At several locations (MW113 and MW114), however, groundwater samples will be collected to also determine the maximum depth penetration of contaminants in the aquifer system. At these locations, the well screen of the deep monitoring well will be set at the deepest contaminated interval.

Collection and analysis of vertical profiling groundwater samples will allow elimination of one or more monitoring wells at certain well nest locations, and allow monitoring to focus on the specific depth of peak contaminant concentrations (or, in the case of MW113 and MW114, the maximum depth of contamination). The collection of vertical profiling groundwater samples will generally be limited to locations which are: 1) more than 500 feet from potential contaminant source areas; and 2) in areas where the pattern of contamination with depth is unknown. The monitoring well locations to be sampled for groundwater during drilling are MW 112, MW113, MW114, and MW119 through MW124.

Collection of vertical profiling groundwater samples will require two different collection methods, based on whether the aquifer material is unconsolidated or bedrock. In the unconsolidated aquifer, groundwater can be sampled by the use of a Hydropunch or similar

TABLE 5-2

PHASE II MONITORING WELL SAMPLING SUMMARY

			Number of Subsurface Soil Samples Submitted for:		Vertical Profiling Groundwater Samples Collected During Drilling	
Well Nest Number	Number and Approximate Depths of Wells	Subsurface Soil Sampling Interval	Chemical Analysis*	Grain-Size Analysis	Number and Sampling Depths for Unconsolidated Deposits (using Hydropunch)	Number and Sampling Depths for Bedrock (using pump and packer)
MW101	One well (MW101C at 172 ft.)	1 ft. below 151 ft. (bedrock cuttings)	0	0	none	none
MW109	One well (MW109D at 45 ft.)	--	0	0	none	none
MW112	Three wells (57, 135, and 350 ft.)	2.5 ft. to bedrock (130 ft.), then 1 ft. (bedrock cuttings) to 350 ft.	3	2	13 (every 10 ft. from 10 ft. to 130 ft.)	none
MW113	Two wells (150 and 230 ft.)	20 ft. to 60 ft., then 10 ft. to bedrock (215 ft.), then 1 ft. (bedrock cuttings) to 230 ft.	0	0	11 (every 10 ft. below 110 ft.)	2 (every 10 ft. below 220 ft.)
MW114	Two wells (150 and 230 ft.)	10 ft. to 50 ft., then 5 ft. to bedrock (215 ft.), then 1 ft. (bedrock cuttings) to 230 ft.	3	2	14 (every 10 ft. below 75 ft.)	2 (every 10 ft. below 220 ft.)

*Chemical analysis of subsurface soil samples encompasses TCL organics, TAL organics, and total organic carbon. (continued)

TABLE 5-2 (continued).

PHASE II MONITORING WELL SAMPLING SUMMARY

			Number of Subsurface Soil Samples Submitted for:		Vertical Profiling Groundwater Samples Collected During Drilling	
Well Nest Number	Number and Approximate Depths of Wells	Subsurface Soil Sampling Interval	Chemical Analysis*	Grain-Size Analysis	Number and Sampling Depths for Unconsolidated Deposits (using Hydropunch)	Number and Sampling Depths for Bedrock (using pump and packer)
MW115	Two wells (70 and 115 ft.)	10 ft. to bedrock (100 ft.), then 1 ft. (bedrock cuttings) to 115 ft.	3	2	none	none
MW116	Two wells (80 and 170 ft.)	10 ft.	0	0	none	none
MW117	Three wells (40, 90 and 160 ft.)	5 ft.	0	0	none	none
MW118	One well (110 ft.)	20 ft.	0	0	none	none
MW119	One well (65 ft.)	5 ft.	3	2	6 (10-ft. intervals)	none
MW120	One well (65 ft.)	5 ft.	3	2	6 (10-ft. intervals)	none
MW121	One well (65 ft.)	5 ft.	0	0	6 (10-ft. intervals)	none
MW122	One well (65 ft.)	5 ft.	0	0	6 (10-ft. intervals)	none
MW123	One well (65 ft.)	5 ft.	0	0	6 (10-ft. intervals)	none
MW124	One well (85 ft.)	5 ft.	0	0	8 (10-ft. intervals)	none
*Chemical analysis of subsurface soil samples encompasses TCL organics, TAL organics, and total organic carbon. (continued)						

TABLE 5-2 (continued)

PHASE II MONITORING WELL SAMPLING SUMMARY

			Number of Subsurface Soil Samples Submitted for:		Vertical Profiling Groundwater Samples Collected During Drilling	
Well Nest Number	Number and Approximate Depths of Wells	Subsurface Soil Sampling Interval	Chemical Analysis*	Grain-Size Analysis	Number and Sampling Depths for Unconsolidated Deposits (using Hydropunch)	Number and Sampling Depths for Bedrock (using pump and packer)
MW125	One well (42 ft.)	5 ft.	0	0	none	none
MW126	Two wells (55 and 85 ft.)	5 ft.	3	2	none	none
MW127	One well (42 ft.)	5 ft.	0	0	none	none
MW128	One well (45 ft.)	5 ft.	3	2	none	none
MW129	One well (50 ft.)	5 ft.	0	0	none	none
MW130	One well (42 ft.)	5 ft.	0	0	none	none
MW131	Two wells (50 and 130 ft.)	5 ft.	3	2	none	none
MW132	Two wells (60 and 130 ft.)	5 ft.	3	2	none	none
MW133	Three wells (40, 80 and 110 ft.)	10 ft.	0	0	none	none
MW134	Two wells (30 and 75 ft.)	10 ft.	0	0	none	none
MW135	One well (60 ft.)	10 ft.	0	0	none	none
MW136	Three wells (30, 70 and 105 ft.)	10 ft.	3	2	none	none

*Chemical analysis of subsurface soil samples encompasses TCL organics, TAL organics, and total organic carbon. (continued)

TABLE 5-2 (continued)

PHASE II MONITORING WELL SAMPLING SUMMARY

			Number of Subsurface Soil Samples Submitted for:		Vertical Profiling Groundwater Samples Collected During Drilling	
Well Nest Number	Number and Approximate Depths of Wells	Subsurface Soil Sampling Interval	Chemical Analysis*	Grain-Size Analysis	Number and Sampling Depths for Unconsolidated Deposits (using Hydropunch)	Number and Sampling Depths for Bedrock (using pump and packer)
MW137	One well (42 ft.)	5 ft.	0	0	none	none
MW138	One well (42 ft.)	5 ft.	3	2	none	none
MW139	One well (42 ft.)	5 ft.	0	0	none	none
MW140	One well (42 ft.)	5 ft.	0	0	none	none
MW141	One well (42 ft.)	5 ft.	0	0	none	none

*Chemical analysis of subsurface soil samples encompasses TCL organics, TAL organics, and total organic carbon.

sampler that can be driven from the base of the borehole into in-place aquifer material. In the bedrock, such a method will not be possible, however. Bedrock intervals will be sampled by inserting a pump and packer assembly approximately five feet above the bottom of the boring. Sampling can be conducted in the open borehole in certain bedrock wells because the air-rotary drilling methods used will employ no drilling fluids that might interfere with collection and analysis of a true in-situ sample of the groundwater.

5.4 GROUNDWATER MONITORING WELL CONSTRUCTION AND INSTALLATION

Phase II groundwater monitoring wells will be constructed with 2-inch diameter riser pipes, well screens, vented caps, and bottom plugs made of Type 304 stainless steel. The riser pipes will be flush-threaded, and joints will be wrapped with Teflon tape during installation to inhibit leakage. The well screens will be 5 or 10 feet long (see Table 5-1), and continuously wound, with a slot size of 0.010 inches.

For monitoring wells set in the bedrock aquifer and where the unconsolidated zone is saturated, a 6-inch outer casing will be installed to prevent interaquifer flow in the borehole. When the bedrock is reached, drilling into the bedrock will continue for 3-5 feet to assure the presence of solid bedrock; then the 6-inch (inside-diameter) steel casing will be placed in the hole and seated in the bedrock (casing will extend to the ground surface). The annular space around the 6-inch casing will then be sealed with a high-solids clay grout from the bedrock to the ground surface. Drilling will then proceed in the bedrock by air-rotary methods; the remainder of the well-installation process will be performed as for other wells. As discussed in subsection 5.1, a second outer casing (10-inch I.D.) will be installed in well MW112C, which will be installed in the St. Peter Sandstone at a location where the unconsolidated and Galena-Platteville aquifers are also present.

The filter pack will be a silt-free silica sand (Wedron 390 or equivalent) which will be sized according to the well screens used and the formations the materials are screened in. The sand will be placed in the bottom-most foot of the borehole to form a pad on which to set the

well. The well will then be emplaced, and the filter pack will be installed from the base of the screen to 2 to 3 feet above the top of the screen. A 1- to 2-foot-thick fine silica sand filter collar will be installed in order to prevent the bentonite seal from infiltrating the filter pack near the screen. A well seal of high-solids clay grout or bentonite chips will then be emplaced from the top of the filter collar to 3 feet below the ground surface. A grout will be the preferred well seal, but bentonite chips may be used in some shallow wells in order to expedite field activities. The grout will be tremmied into the annular space from the bottom, in order to prevent the formation of gaps in the well seal.

The remaining three feet of the borehole will be filled with concrete in which a protective well casing will be set. The protective well casing will be a minimum of 5 inches in diameter and equipped with a locking cap, which will maintain the integrity of the well. The protective casing should be 5-6 feet in length, in order to allow the casing to extend 6 inches above the 2-3 foot stick-up of the riser pipe. The outer casing will have two 1/4-inch holes drilled approximately 6 inches above ground level, to prevent the outer casing from filling with water. The outer casing will be filled with washed pea gravel to 6 inches below the top of the riser pipe.

A 2-foot diameter concrete apron will be installed at the ground surface around the outer casing. The concrete apron will be sloped radially away from the well to facilitate surface drainage. If necessary, other measures will be taken to eliminate the possibility of surface water ponding near the borehole. The concrete apron will be separated from the 3-foot concrete plug by a joint, to minimize the effects of frost-heave. Six-foot steel bumper posts will be set in concrete around the well nests, in order to prevent damage to the wells from vehicles. Monitoring well construction is schematically illustrated on Figure 5-1.

At certain locations such as in residential areas, flush-mounted wells may be installed in order to minimize the physical and visual impact of the monitoring wells. For such installations the riser pipe and the protective casing (including locking cap) will be set at

ground level, and the concrete pad and bumper posts will be eliminated. Flush-mounted wells will be installed only at the request of the IEPA.

5.5 SOIL SAMPLING PROCEDURES AND EQUIPMENT

Subsurface soil samples will be collected from source investigation wells and borings, from groundwater investigation wells, and from test pits in Area 7. These samples will be collected for analytical, geotechnical and lithologic purposes. Subsurface soil samples from wells and borings will be collected with a split-spoon sampler in accordance with ASTM standards. The sampling interval will generally be five feet for source investigation wells and borings, and 10 feet for groundwater investigation wells. At several locations, more frequent sampling will be conducted in order to provide more complete stratigraphic information. If possible, the soil samples will be collected from the deepest borehole of each well nest. Subsurface samples from test pits will be collected with the scoop of the backhoe. The following paragraphs detail the purpose and the frequency of the analytical, geotechnical and lithologic samples to be collected. General soil sampling procedures are further discussed in Appendix B.

Analytical Samples: The objectives of analyzing subsurface soil samples are: 1) to define soil contamination near potential source areas (for source investigation wells and borings and for test pits); 2) to determine background soil chemical characteristics away from source areas; and 3) provide information about contaminant partitioning between the groundwater and soil media, which is in turn important to define in assessing both contaminant plume migration and remediation alternatives. Samples that will fulfill the latter objective include samples from wells and borings located near potential sources, and wells located farther from potential sources but still within the plume. Soil samples from wells located outside the contaminant plume will allow characterization of background chemical constituents in the study area.

For subsurface borings (all are located near potential source areas), the subsurface samples will be collected at five-foot intervals, and from the unsaturated zone only. These samples will be screened in the field for VOCs with an OVM, and the two subsurface samples with the highest screening concentrations of VOCs will be submitted for chemical analysis. Field screening will consist of placing a small amount (6-7 grams) of a representative subsurface soil sample into a 4 oz. laboratory jar or a plastic bag. The jar mouth will then be covered with aluminum foil (or the bag closed) and allowed to sit for approximately one-half hour at a temperature 60 degrees F or greater. The organic vapor content inside the sample jar will then be determined by piercing the aluminum foil with the instrument probe and noting the organic vapor level. Levels will be recorded in the sample field book. Procedures for the field organic vapor detection instrument are provided in Appendix C. If elevated VOCs are not detected in a particular boring, the single sample nearest the water table will be submitted for laboratory analysis. The analyses to be performed on these samples from subsurface borings are TCL organics and TAL organics.

For monitoring wells installed for both the source investigation and the groundwater investigation, the subsurface samples will generally be collected from the deepest well at each nest at five-and 10-foot intervals, respectively. However, subsurface soil samples will be submitted for laboratory analysis from only approximately 20% of Phase II wells (10 locations); of the monitoring wells from which soil samples will be submitted, approximately three samples will be submitted from each well, and samples will be from the saturated zone only. The specific wells to be sampled for analytical purposes are listed in Table 5-2, and have been selected in order to provide data representative of the study area, including locations near sources, in the plume, and in background areas. At each monitoring well sampling location, the samples to be submitted for analysis will be one sample from the screened interval, if possible, and approximately two samples from unconsolidated stratigraphic units different from the screened interval sample. Analyses to be performed on these samples are TCL organics, TAL inorganic, and total organic carbon. The total organic carbon analysis will allow estimation of the partitioning preference of contaminants between the groundwater and the solid materials of the aquifer.

Due to the potentially high gravel content of the soils to be encountered, it may not be possible to obtain sufficient sample volume for all parameters. Based on existing data and limited knowledge of potential industries in the area, if insufficient volume is available, volatile organics will be the first priority to be collected, metals and cyanide will be the second priority and extractable organics will be the third priority collected for analysis.

All subsurface analytical soil samples will be collected from decontaminated split-spoon samplers provided by the subcontracted drilling firm during drilling activities. Sample collection procedures are summarized as follows:

- The split-spoon sampler will be placed on a decontaminated stainless steel tray and opened following recovery of the sampler from the borehole;
- Soil samples will be transferred from the split-spoon sampler into laboratory-sterilized sample jars by CDM field samplers wearing surgical gloves using decontaminated stainless steel spatulas or stainless steel scoops (sample containers are listed in Tables 3-1 and 3-2);
- The sample bottle lids will be securely tightened to the sample jars;
- The exterior of the filled sample jars will be decontaminated as described in Section 6;
- Samples collected for field organic vapor monitoring will be screened and values will be recorded in the sample field book.
- The lithologic, visual and olfactory characteristics, OVM readings as well as the sample depth and identification designation (as described in subsection 3.5.2) will be recorded in the field book; and

- The sample jars will be sealed in a zip-lock bag and immediately placed in an iced cooler.

At test pits, subsurface soil samples will be collected with the backhoe bucket. Each bucket will be scanned for VOCs using an HNu, OVM or equivalent, and the contents will be characterized visually. Approximately four samples will be collected from each test pit. Sample selection will be based primarily upon visual characteristics (i.e., soils saturated with product will be selected for analysis), and secondarily upon VOC concentrations (the samples with the highest VOC screening concentrations will be selected). If four samples cannot be selected from a test pit by visual or VOC screening methods, samples will be selected based on geographic coverage, with samples being collected from different portions of the test pit. The analyses to be performed on these samples are TCL organics and TAL inorganics. The two most contaminated samples (based on screening characteristics) will also be submitted for analysis of TCLP parameters. Both the excavation and sampling of test pits will be conducted by subcontractor crews overseen by CDM.

Specific soil sampling procedures for the test pits will be the same as those outlined in the above bullets for subsurface samples collected at wells and borings, except that the sampling device will be a backhoe bucket instead of a split-spoon sampler, and organic vapor monitoring will be conducted by scanning the contents of each backhoe bucket immediately after retrieval of the filled bucket. Samples saturated with product will be considered high-concentration samples and will be shipped accordingly. Other samples from test pits will be considered medium-concentration samples; all samples from test pits will require special packaging, as discussed in subsections 3.1 and 3.3.

Geotechnical Samples: Two subsurface soil samples will be submitted for grain-size analysis from the saturated zone of each of the wells sampled for analytical purposes (discussed above and listed in Table 5-2). As with the samples selected for analytical purposes, the samples for grain-size analysis will be selected to be representative of the lateral and vertical variations in the unconsolidated stratigraphic units across the study area. Where possible,

one of the two samples will be from the screened interval. The purpose of submitting the grain-size samples is to assess the proportion of clay-sized materials available for adsorption of organics in the site aquifers, and to assist in the analysis of hydraulic conductivity of the aquifers.

Lithologic Samples: Lithologic samples will be collected for the purpose of determining and describing the geologic materials present at depth. The lithologic samples will be visually inspected and classified by CDM's onsite geologist. In practice, all subsurface soil samples from wells and borings will be used for lithologic purposes. As noted above, the sample intervals will generally be five feet for source investigation wells and borings, ten feet for groundwater investigation wells, one foot for cuttings samples of bedrock intervals (discussed below), and 2.5 feet at several locations. The lithologic samples will be used to gain a clear understanding of the nature of the materials present at depth, to aid description of geologic materials penetrated by the boreholes, to assist in stratigraphic correlation of clay deposits, and to define preferential pathways of groundwater (and contaminant) migration.

In the bedrock portion of boreholes that penetrate bedrock, split-spoon sampling will not be possible. However, samples of the bedrock cuttings will be collected as they emerge from the borehole, at a frequency of one sample per foot. The onsite geologist will examine and log these cuttings for lithologic purposes.

5.6 GROUNDWATER SAMPLING PROCEDURES AND EQUIPMENT

Groundwater samples will be collected from the 83 wells installed during Phases I and II of the RI, approximately 21 ISWS wells and 19 industrial facility wells (see Figure 4-13; industrial facility wells are listed in Table 5-3). In addition, 25 residential wells will be sampled in Phase II (see Table 5-4).

TABLE 5-3
INDUSTRIAL WELLS TO BE SAMPLED IN PHASE II

IW 1	707 Harrison Ave. - Rockford Products Corp. - Plant #3 supply well
IW 2	2647-8th Street - Estwing supply well
IW 3	1915-20th Ave. - Acme solvents well G103S
IW 4	1915-20th Ave. - Acme solvents well G104
IW 5	1915-20th Ave. - Acme solvents well G101
IW 6	2210 Harrison - SunTec well MW6
IW 7	2210 Harrison - SunTec well MW7
IW 8	2210 Harrison - SunTec well MW5
IW 9	2210 Harrison - SunTec well MW3
IW 10	2524-11th Street - Rockford Graphics MW1 (in R.R. right-of-way)
IW 11	2524-11th Street - Rockford Graphics MW2
IW 12	2020 Harrison - Borg-Warner
IW 13	2020 Harrison - Borg-Warner
IW 14	4960 - 28th Ave. - Erhardt-Leimer MW-10D
IW 15	4747 Harrison - Sundstrand MWS40
IW 16	707 Harrison - Rockford Products Mon. well W6
IW 17	707 Harrison - Rockford Products Mon. well W3
IW 18	2602-17th Street - East Rockford Collision Center
IW 19	123 Energy Street - Commonwealth Edison

patched over
MW4

*reports by HLA
to Sundstrand*

MW 13: next week

MW 12: Elkburg

*Suntec Two ft
TWR*

MW 15: ~~000000~~ S of 106

TABLE 5-4
RESIDENTIAL WELLS TO BE SAMPLED IN PHASE II

3107 Grant Park Blvd.
409 Brooke Road
804 Taft Street
841 Roosevelt Road
3115 Seventh Street
3237 Eighth Street
3301 Eighth Street
3022 Eighth Street
3138 Eighth Street
3126 Collins Street
3310 Collins Street
3021 Ninth Street
3226 Ninth Street
2929 Eleventh Street
1713 Harrison Avenue
1726 Pershing Avenue
1735 Hamilton Avenue
3131 Sewell Street
3106 Marshall Street
2131 Harrison Avenue (2 Wells - Barrett's Mobile Home Park)
3118 Seventeenth Street
3110 Eighteenth Street
3112 Nineteenth Street
3024 Twentieth Street

Groundwater samples secured from Phase I wells, Phase II groundwater investigation wells, ISWS wells, industrial wells and residential wells will be analyzed for VOCs. Samples from Phase II source investigation wells will be sampled for TCL organics and TAL inorganics. These are the classes of compounds expected to be present based on existing data and source information. Because groundwater is currently used as a potable water source in the area, lower detection limits will be required for VOCs to allow a comparison with drinking water standards. In addition, selected wells (as listed in Table 5-5 and which are representative of the contaminant plumes in the various aquifers) will be analyzed for general water chemistry parameters including minerals (alkalinity, fluoride, sulfate, chloride, and silica), nutrients (ammonia, COD, total kjeldahl nitrogen, nitrate, nitrite, total phosphorus, and total organic carbon), total dissolved solids, and total suspended solids, for remedial design purposes. These parameters are useful in evaluating most conventional remedial treatment methods for contaminated groundwater, including air stripping, carbon adsorption, bioremediation, and chemical treatment methods.

The groundwater sample volumes, containers, and preservation techniques are shown in Table 3.1.

The sampling equipment and procedures for the monitoring wells are summarized as follows:

- The air above the water column in the casing of the monitoring well will be screened for organic vapors with an HNu or OVM. The reading of the instrument will be recorded in a sample field book.
- The depth to water in the well will be measured with a decontaminated and calibrated electronic depth to water meter.

TABLE 5-5
MONITORING WELLS TO BE SAMPLED IN PHASE II

CDM WELLS	VOCs ONLY	FULL TCL ORGANICS AND TAL INORGANICS	GENERAL WATER CHEMISTRY PARAMETERS
MW101A	x		x
MW101B	x		x
MW101C	x		
MW101D	x		
MW102A	x		
MW102B	x		
MW102C	x		
MW103A	x		
MW103B	x		
MW103C	x		
MW103D	x		
MW104A	x		
MW104B	x		
MW104C	x		
MW105A	x		
MW105B	x		
MW105C	x		
MW105D	x		
MW106A	x		
MW106B	x		
MW106C	x		
MW107A	x		
MW107B	x		
MW107C	x		
MW108A	x		
MW108B	x		
MW108C	x		
MW109A	x		
MW109B	x		
MW109C	x		
MW109D	x		
MW110A	x		
MW110B	x		
MW110C	x		
MW111A	x		
MW111B	x		
MW111C	x		
MW112A	x		
MW112B	x		x
MW112C	x		x
MW113A	x		x

TABLE 5-5 (Cont'd)
MONITORING WELLS TO BE SAMPLED IN PHASE II

CDM WELLS	VOCs ONLY	FULL TCL ORGANICS AND TAL INORGANICS	GENERAL WATER CHEMISTRY PARAMETERS
MW113B	x		
MW114A	x		x
MW114B	x		x
MW115A	x		
MW115B	x		
MW116A	x		
MW116B	x		
MW117A	x		x
MW117B	x		x
MW117C	x		x
MW118A	x		x
MW119A		x	
MW120A		x	x
MW121A		x	
MW122A		x	
MW123A		x	
MW124A		x	
MW125A		x	
MW126A		x	x
MW126B		x	x
MW127A		x	
MW128A		x	x
MW129A		x	
MW130A		x	
MW131A		x	x
MW131B		x	x
MW132A		x	x
MW132B		x	x
MW133A		x	
MW133B		x	
MW133C		x	
MW134A		x	
MW134B		x	
MW135A		x	
MW136A		x	x
MW136B		x	x
MW136C		x	x
MW137A		x	
MW138A		x	x
MW139A		x	

TABLE 5-5 (Cont'd)
MONITORING WELLS TO BE SAMPLED IN PHASE II

CDM WELLS	VOCs ONLY	FULL TCL ORGANICS AND TAL INORGANICS	GENERAL WATER CHEMISTRY PARAMETERS
MW140A		x	
MW141A		x	
ISWS WELLS			
MW1	x		
MW5	x		x
MW9	x		
MW12	x		
MW17	x		
MW19	x		
MW20	x		
MW22	x		
MW29	x		
MW30	x		
MW32	x		
MW34	x		
MW36	x		
MW37	x		
MW38	x		
MW41	x		
MW43	x		x
MW45	x		
MW46	x		x
MW47	x		
MW48	x		
IW1	x		
IW2	x		
IW3	x		
IW4	x		
IW5	x		
IW6	x		
IW7	x		
IW8	x		
IW9	x		
IW10	x		

TABLE 5-5 (Cont'd)
MONITORING WELLS TO BE SAMPLED IN PHASE II

CDM WELLS	VOCs ONLY	FULL TCL ORGANICS AND TAL INORGANICS	GENERAL WATER CHEMISTRY PARAMETERS
IW11	x		
IW12	x		
IW13	x		
IW14	x		
IW15	x		
IW16	x		
IW17	x		
IW18	x		
IW19	x		
25 residential wells	x		

- Based on the water level measurement and the total depth of the well, the volume of standing water in the well will be calculated.
- The well will be purged using a positive displacement pump constructed of chemically inert materials. The standard procedure will be to pump until at least three well volumes have been removed. The pump head will be positioned five to ten feet below the water level.
- For residential wells, purging can be held to a minimum (approximately 1 minute), because most or all residential wells to be sampled will be in use. For any residential wells not in use, purging will continue for 10 to 15 minutes.
- Beginning with the fourth volume, periodic measurements of pH, specific conductance and temperature will be made using the procedures contained in Appendix D.
- Purging may cease when measurements for all three parameters have stabilized (± 0.25 pH units, ± 50 umhos/cm, and $\pm 0.5^\circ\text{C}$) for three consecutive readings or after five well volumes have been removed.
- If a well is pumped dry before three volumes have been removed, it will be allowed to recharge for 15 minutes and then pumped dry again. The sample will be collected after the next episode of recharge.
- The sample will be obtained with a stainless steel or Teflon bailer, or using a positive-displacement bladder pump designed for sampling purposes. The bailer will be raised and lowered in the well using a new length of nylon cord at each location. Care will be taken during lowering and raising the bailer to

avoid agitation of the sample water. If a bailer is used, it will be lowered to the depth of the screened interval for sample collection.

- Samples will be collected in laboratory-sterilized sample bottles. Sample bottles will be slowly filled, avoiding agitation of the sample.
- Surgical gloves will be worn by the sampler while collecting the sample to avoid cross-contamination.
- After filling each VOA sample bottle, the cap will be securely tightened and the bottle will be inverted and tapped firmly on the heel of the hand. If bubbles are visible, the bottle will be emptied and discarded and a new sample will be collected in a new sample bottle. All other sample bottles will be filled to their respective fill levels and preserved (if required) with their respective preservative.
- A filtered sample will be collected for metals analysis. Filtering will be performed during sample collection at the well (i.e., within 15 minutes of sample collection). The filtering procedure is provided in Appendix D.
- The exterior of the filled sample bottles will be decontaminated by washing in a non-phosphate soap solution and rinsing with tap water.
- Field measurements (pH, temperature, specific conductance), field observations (color, odor, turbidity), and the sample designation will be recorded in a sample field book.
- The sample bottles will be appropriately labeled as described in subsection 3.5.2, sealed in a zip-lock bag and immediately placed in an iced cooler.

5.7 HYDRAULIC CONDUCTIVITY TESTING

In order to characterize hydraulic properties of the aquifer, hydraulic conductivity tests will be performed on each of the monitoring wells installed during Phase II. The wells will be tested using the "slug test" technique, where water level in the wells is instantaneously changed, by physically raising or depressing the water level in the well, and the water level recovery to the equilibrium level is recorded electronically with a pressure transducer. Many of the Phase II wells are expected to be screened in sand and gravel zones of the unconsolidated deposits. These deposits typically have hydraulic conductivities in range of 10^{-2} to 10^{-3} m/sec (Freeze and Cherry, 1979); therefore recovery times are expected to be short (1-2 minutes). Because of the short recovery times, it will be necessary to take measures to minimize splashing during the early part of the water level recovery. In order to meet this objective, CDM will use air pressure to depress water levels in the wells. This will be accomplished by using a pressurized air source (SBCA tank) attached to a pressure regulator which is in turn coupled to the well by an adapter. Prior to the test, water level will be depressed to a level of 5 to 10 feet below the equilibrium level by applying a constant air pressure, and allowed to equilibrate. To start the test, the pressure will be instantaneously released through a large-diameter valve, and the water level recovery will be electronically recorded with a Hermit Environmental Data Logger attached to a pressure transducer.

In a conventional slug test, a physical "slug" of known volume is attached to a rope and inserted or removed from a well to initiate an instantaneous water level change. The use of air pressure to initiate the water level change offers two advantages over the conventional method:

1. It is possible to cause a greater water level change with air pressure than with a slug. Water level changes of 10 feet are easily obtainable with the air pressure method, whereas water level changes on the order of 0.5 to 1.5 feet are typical for a conventional slug.

In aquifers with high hydraulic conductivities, larger water level changes are associated with longer recovery times which produces more easily interpretable data.

2. Because nothing is actually inserted into the well when using the air pressure method, splashing and dripping are minimized, thus minimizing interference during the early portion of the water level recovery curve and assisting data interpretation.

For these reasons, the use of air pressure to initiate water level changes will be the preferred method for conductivity tests. If, however, this method proves impracticable in the field, the more conventional slug test method will be used.

Water level records will be inspected in the field to assure that the data from each test has been properly recorded and the recovery curves are interpretable. A minimum of three conductivity tests will be performed for each well.

The water level recovery curves will be analyzed by the method of Hvorslev as described in Freeze and Cherry (1979) and/or the method of Bouwer and Rice (1976), in order to determine numerical values for hydraulic conductivities.

6.0 DECONTAMINATION PROCEDURES

Procedures to be followed to decontaminate equipment and personnel are fully described in the Southeast Rockford Health and Safety Plan. The procedures are summarized below and are further detailed in Appendix E.

6.1 PERSONNEL DECONTAMINATION

Personnel decontamination stations will be set up at the edge of each study area. Personnel will become thoroughly familiar with the decontamination procedure before work begins in exclusion zones. The exclusion zone will be defined as an area 25 feet surrounding the drilling, soil gas collection points, and groundwater sample collection points. The decontamination procedure is as follows:

- Place equipment and/or samples in segregated equipment drop-areas.
- Remove disposable outer booties (when used).
- Remove chemical resistant outer gloves (when used).
- Remove hard hat, goggles-safety glasses-face shield (when used).
- Remove inner disposable gloves.
- Wash hands and face with water and hand soap.

6.2 EQUIPMENT DECONTAMINATION

Decontamination of large equipment (vehicles, backhoes, drill rigs and associated equipment) will be performed at a portable cleaning station (decontamination pad). The decontamination pad will be approximately 20 ft. larger and 20 ft. wider than the largest drilling vehicle used for site work. The station will consist of a seamless heavy gauge (30 mil or greater) plastic sheet, or other material of equal quality, which shall be laid over the ground surface. As necessary, a base of sand will be placed on the ground to prevent damage to the membrane

liner from sharp protrusions in the ground. The sides of the sheet will be raised by tacking them to a 2-inch x 4-inch (common two-by-four) length of wood, thereby creating a lip along the perimeter. The front and rear of the sheet will be placed over a small, smooth soil berm to permit the drilling equipment to drive onto and off of the plastic sheet.

All equipment will be steam-cleaned at the decontamination pad prior to initiation of work at the site. This includes excavation equipment, drill rigs, casing, rods, bits, split-spoon samplers, tools, and any other equipment brought on-site.

Between samples, the sampler will be decontaminated. Between boreholes all casing, rods, samplers, and other equipment used in the boreholes, including the mud pump, will be decontaminated. Between test pits all excavation equipment will be decontaminated. On the larger machines the decontamination procedure will focus on tracks, wheels, buckets or blade, and any obvious gross contamination (e.g., oil leaks) on the body of the machine.

Upon completion of drilling activities, all equipment including the drill rig, all casing, rods, tools, and miscellaneous equipment will be decontaminated before leaving the site.

All soil and groundwater sampling equipment will be decontaminated prior to use, and all reusable non-dedicated equipment (scoops, buckets, core samplers, dredges, bottle sampler) will be decontaminated between samples, and before removal from the site. The procedure is given in Table 6-1.

6.3 SAMPLE BOTTLE DECONTAMINATION

Sample bottles for shipment to the laboratories will be decontaminated by immersing the bottle up to the neck in soap (Alconox or equivalent) and water solution and then rinsing with potable or distilled water. Solvents will not be used to wash sample bottles.

TABLE 6-1
STANDARD DECONTAMINATION PROTOCOL FOR SAMPLING EQUIPMENT

STEP 1 -- Scrub equipment thoroughly with soft-bristled brushes in a low-sudsing detergent solution.

STEP 2 -- Rinse equipment with tap water by submerging and/or spraying.

STEP 3 -- Rinse equipment with distilled water by spraying until dripping.

STEP 4 -- Place equipment on plastic or aluminum foil and allow to air dry for five to ten minutes.

STEP 5 -- Wrap equipment in plastic or aluminum foil for handling and/or storage until next use.

NOTE: In order to avoid analytical problems caused by solvent use in decontamination, solvents will not be used for decontamination. Only distilled water shall be used for rinsing equipment. An exception will be made if upon visual observation or high organic vapor readings it is determined that a zone of highly contaminated material is encountered. In such an event, isopropyl alcohol will be used before step 1 above.

6.4 STORAGE AND DISPOSAL OF PHASE I RI-GENERATED WASTES

The sampling and drilling activities are expected to generate solid and liquid "waste." The activities, the anticipated type and the planned handling of the wastes are summarized below.

- Monitoring well installation: SOLID: auger cuttings and excess soil/cuttings collected and retained in drums for future disposal as directed by the IEPA; LIQUIDS: removed during well development -- retained in drums and disposed of as directed by IEPA.
- Groundwater sampling: SOLID -- none; LIQUID -- retained in drums and disposed of as directed by IEPA.

All disposable protective clothing, disposable sampling equipment and liquids generated by decontamination procedures will be contained in 55-gallon drums and stored in a secure area designated by IEPA. Disposal of these materials will be as directed by IEPA.

Solids and liquids will be contained separately. Ultimate disposal of RI-generated wastes will proceed as directed by IEPA.

7.0 FIELD QUALITY CONTROL PROCEDURES

To ensure the level of data quality required for Superfund Remedial Investigations, the following Quality Control (QC) procedures will be performed. QC sample requirements are summarized in Table 1-1.

7.1 SOIL AND GROUNDWATER QC SAMPLES

Field Duplicates

One duplicate soil and groundwater sample will be collected for every 10 samples (or portion thereof) collected in the field. Duplicate samples will be collected at the same sample volume and in the same type of container as other samples. Duplicate sample quantities and collection shall apply to both soil and water samples.

Field Blanks

One field blank water sample will be prepared for every ten groundwater samples collected. Field blanks will be prepared by filling water sample bottles with reagent-grade distilled water from the sampling device (if possible), at the same volume as the groundwater samples. Sample bottles for all parameters will be prepared. These samples will be prepared in close proximity to an actual sample location. This location will be recorded in the sample field log book. For metals and cyanide analysis, the field blanks (for these filtered samples) shall be prepared by filling the sample bottles with reagent-grade distilled water that has been routed through the decontaminated sampling devices, including the decontaminated filter.

Trip Blanks

A trip blank for volatile organic analysis (VOA) will be included in each sample shipment for volatile organic analysis. The trip blank will consist of four 40-ml VOA vials filled with reagent-grade distilled water. The trip blank will be prepared in the office or laboratory, transported to the field, and shipped with the other samples to the CLP without being opened. The trip blank will be documented on a SAS report form for shipment to the Contract Laboratory Program.

Matrix Spike and Matrix Spike Duplicates

All samples designated as MS/MSD samples will be collected as specified in the USEPA Region V Sample Handling Manual. Matrix spike samples will be denoted by the sample number followed by an -MSD suffix on sample tags, chain-of-custody forms, and other appropriate sample paperwork.

Water samples for semivolatile (extractables and pesticides/PCBs) MS/MSD analysis will be collected at double volume at a frequency of one per twenty samples. No additional water sample volume will be required for TDS, TSS, metals, cyanide, minerals, or nutrients as well as all parameters for any soil samples. MS/MSD analysis is not required for low concentration volatile organics.

Performance Evaluation Samples

Performance Evaluation Samples (PES) will be submitted with the low concentration volatile organic samples. One PES will be submitted for every 20 samples shipped or once during each 7-day calendar period of sample shipping. PES samples will be supplied to CDM by USEPA CRL.

7.2 VERTICAL PROFILING QC SAMPLES

One duplicate sample will be analyzed for every 10 vertical profiling groundwater samples (collected for screening purposes during drilling). Duplicate samples will be collected at the same sample volume and in the same type of container (40-ml VOA vials) as other samples.

One field blank sample will be analyzed for every 10 vertical profiling groundwater samples. Field blanks will be prepared by filling the 40-ml VOA vials with reagent-grade water from the same sampling device (if possible), at the same sampling volume as the other vertical profiling samples. The field blank sampling location will be recorded in the field log book.

APPENDIX A

U.S. EPA REGION V SAMPLE HANDLING MANUAL

SF SAMPLE DOCUMENTATION REQUIREMENTS

Contract Laboratory Program

Traffic Reports	C-1 through C-12
Chain of Custody Form	C-13 through C-15
SAS Packing List	C-16 through C-17
Sample Tags	C-18 through C-19
CRL Sample Data Report	C-20 through C-22
Chain of Custody Seals	C-19
Dioxin Shipment Record	C-23 through C-24

Central Regional Laboratory

Chain of Custody Form	C-13 through C-16
EPA CRL Analysis Request Form	C-25 through C-26
Sample Tags	C-18 through C-19
Chain of Custody Seals	C-19

SAS PACKING LIST

1. Insert assigned SAS case number.
2. Insert EPA region number, V and your contractor company name.
3. Insert sample team leader's name.
4. Insert sample team leader's office telephone number (do not use field office telephone number).
5. Insert date sample was taken.
6. Indicate date of shipment.
7. Insert the site name only if it does not copy onto the lab's copy (see note below). Also list the site/spill ID.
8. Insert laboratory name and address, and the carrier name and airbill number.
9. Indicate name of laboratory contact.
10. List SAS sample numbers, which should include SAS number (i.e., if the SAS # is 2743E, the samples would be numbered as 2743E-01, 2743E-02, etc.)
11. Specify sample matrix, concentration, tag number, and analysis to be performed (e.g., low concentration soil sample for PCB analysis, tag number 5-48246).
Indicate whether shipment is complete at the bottom of the form.
12. Leave BLANK - laboratory use only.

NOTE: The site name should not be written on this form while all copies are attached if there is no protection to prevent the site name from appearing on the lab's copies. The CLP laboratory should not have this information. Therefore, either use a site code or separate the copies and only write the site name on the Regional and SMO copies of this form, if necessary.

THIS IS A FOUR COPY FORM:

The top copy should be sent to SMO within a day or two of shipping samples.

The second (yellow) copy should be sent with other paperwork for a site to the Region V RSCC.

The bottom two copies (pink and gold) get sent to the CLP laboratories with the samples.

U.S. ENVIRONMENTAL PROTECTION AGENCY
 CLP Sample Management Office
 P.O. Box 818 - Alexandria, Virginia 22313
 Phone: 703/557-2490 - FTS/557-2490

① SAS Number

SPECIAL ANALYTICAL SERVICE
 PACKING LIST

Sampling Office: ②	Sampling Date(s): ⑤	Ship To: ⑧	For Lab Use Only
Sampling Contact: ③ (name)	Date Shipped: ⑥		Date Samples Rec'd:
④ (phone)	Site Name/Code: ⑦	Attn: ⑨	Received By:

Sample Numbers	Sample Description Le., Analysis, Matrix, Concentration	Sample Condition on Receipt at Lab
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10. ⑩	⑪	⑫
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		

For Lab Use Only



White - SMO Copy, Yellow - Region Copy, Pink - Lab Copy for return to SMO, Gold - Lab Copy

SAMPLE TAG

1. Enter your project number for the site, which may be the first six digits of the CRL log number (see page C-21).
2. Enter the sampling station code. i.e., MW1, BLK, SS1, etc.
3. Enter date of sampling.
4. Enter time of sampling (military time only).
5. Specify "grab" or "composite" sample with an "X".
6. Insert station location. If the sample is a field blank or if to be used for the spike or duplicate analysis, notate here.
7. Obtain signature of sample team leader.
8. Indicate presence of preservative with an "X".
9. Specify analytes for analysis with an "X".
- 10a. Indicate traffic report number (i.e., EV846 or MEX013) for that sample if the samples are being shipped to the CLP. If the samples are going to the CRL, list the CRL log number.
- 10b. Indicate the case number.
11. Leave BLANK (for laboratory use only).
12. Enter any desired analyses not listed on the tag provided (e.g., PCB's, ammonia, sulfide, etc.) and mark the box with an "X".

NOTE: Each sample container should have a separate tag.
All field blanks should be designated as such on the sample tags, either in the 'Remarks' field (10a and 10b) or in the 'Station Location' field (6).

Sample Tag

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION 5 230 South Dearborn Street Chicago, Illinois 60604 				 (5)		Dry Ice <input checked="" type="checkbox"/> Ice <input type="checkbox"/> Camp <input type="checkbox"/>	
						Time (4)	
Month/Day/Year (3)	Station No. (2)	Station Location (6)		Signature (Signature) (7)		Preservative: Yes <input type="checkbox"/> No <input type="checkbox"/>	
Project Code (1)	Tag no. 5- 32261					Lab Sample no. (11)	
ANALYSES (8)				(9)		(12)	
BOD Anions							
Solids (total suspended solids)							
COD, TOC, Nutrients							
Phenolics							
Mercury							
Metals							
Cyanide							
Oil and Grease							
Organics GC/MS							
Priority Pollutants							
Volatile Organics							
Pesticides							
Mutagenicity							
Bacteriology							
Remarks: (10a) (10b)							

Front

Back

Each cooler should have 2 CDC seals applied.

U.S. ENVIRONMENTAL PROTECTION AGENCY REGION 5 OFFICIAL SEAL No. 13400
--

Chain of Custody Seal

INTRODUCTION AND INSTRUCTIONS FOR USE OF MULTI-SAMPLE ORGANIC AND INORGANIC TRAFFIC REPORTS

A. Introduction: Samples and Sample Numbers

Contract Laboratory Program (CLP) multi-sample Traffic Reports (TRs) can document up to twenty samples shipped to one CLP laboratory under one Case Number. The TRs must be used for every shipment of RAS samples to a CLP laboratory.

The CLP's definition of "samples" is based on the RAS analytical program: (1) organic, (2) VOA only (3) inorganic.

A CLP sample is one matrix — water or soil — and consists of all the sample aliquots from a sample station location for analysis in one RAS analytical program. The CLP assigns a unique Sample No. to each such set of aliquots sent to one CLP laboratory. The unique Sample Numbers are printed on the adhesive labels. The samplers must accurately transfer this critical Sample Number to the TR.

Organic Sample Numbers are in the format XX123, and have six labels per strip: four for extractables, and two for VOAs (see attachment). CAUTION: The organic sample labels provide two options for each Sample No. — labels for water samples and labels for soil samples. USE ONLY ONE OF THE TWO OPTIONS. An individual sample will be analyzed as EITHER a water or a soil, but never both. DESTROY THE UNUSED LABELS to prevent duplication of Sample Numbers.

Inorganic Sample Numbers are in the format MXX123 and have seven labels per strip: two for Total Metals, two for Cyanide and three extra (see attachment). Remember that the unique Sample No. must only be used once so DESTROY THE EXTRA LABELS.

Use only the labels provided to the Region in which you are sampling. CLP Sample Numbers are an alphanumeric code specific to each Region:

Letter Code	
<u>Organic</u>	<u>Inorganic</u>
Region	Region
A, MA	I
B, MB	II
C, MC	III
D, MD	IV
E, ME	V

Letter Code	
<u>Organic</u>	<u>Inorganic</u>
Region	Region
F, MF	VI
G, MG	VII
H, MH	VIII
Y, MY	IX
J, MJ	X

REMEMBER:

- o TRs must be used for each Case No. with every shipment of samples to each CLP laboratory.
- o Organic samples, "VOA Only" samples, and inorganic samples are assigned separate, unique Sample Numbers. Each consists of all the sample aliquots from a sample station location.
- o A CLP RAS sample will be analyzed as either a water or a soil sample.
- o Prevent accidental duplication of Sample Numbers by destroying unused labels.
- o Use only the Sample Numbers specific to your Region.

B. Completing the Form - Case Documentation

Enter the Case No. and SAS No. (if applicable) at the top right of the form. Complete the boxes in the header.

Box No. 1:

Type of Activity:

If sampling is under Superfund, circle the code which describes the task of the sampling mission:

PA -	Preliminary Assessment
SI -	Site Investigation
ESI -	Expanded Site Investigation
RIFS -	Remedial Investigation Feasibility Study
RD -	Remedial Design
RA -	Remedial Action
ER -	Emergency Response (Removal)
NPLD -	National Priorities List Delete
O + M -	Operations and Maintenance

If sampling is not under the Superfund program, enter the name of program, e.g., RCRA. Enter the site name, the city, state, and Site Spill ID (provided by Region) in the designated spaces.

Box No. 2:

Regional Information

Enter the Region number, the name of your sampling company, and your name in the designated spaces.

Box No. 3:

Ship To:

Enter the name of the CLP laboratory and its full address in the box. Enter the name of the sample custodian or CLP contact in the box provided.

Enter the beginning and ending sampling dates in the designated spaces.

Enter the date shipped, the carrier code (e.g., F = Federal Express, P = Purolator, etc.) and the airbill number in the appropriate spaces.

C. Completing the Form - Sample Documentation

Carefully transcribe the CLP Sample No. from the printed sample labels on the TR in the space provided.

Complete columns A through E to describe the sample:

Column A, Sample Description:

Enter the appropriate sample description code from Box 6. NOTE: Describe RINSATES or BLANKS as #3 "Leachate" in Column A. Write the word "Rinsate" or "Blank" in Column D, the Special Handling section, or in Column E, the Station Location section. Note: Item #3 "Oil" and Item #7 "Waste" are for RAS PLUS SAS projects only. Do not ship oily samples or waste without making prior arrangements with SMO.

Column B, Concentration:

Organic - If sample is low or medium concentration, enter "L". When shipping RAS plus SAS high concentration samples (previously arranged with SMO), enter "H".

Inorganic - Enter "L" for low concentration, "M" for medium concentration, and "H" for high concentration (under previous RAS plus SAS arrangement).
REMINDER: Ship medium and high concentration organic and inorganic samples in metal cans.

Column C: RAS Analysis

Check the analytical fractions requested on each sample.

Column D: Special Handling

Use this space to relevant specify any special handling requirements. Rinse or blank samples should be identified as such in this space. When shipping RAS plus SAS samples you may code SAS parameters in the blank space (e.g., A = sulfate, B = Cl, etc.) and enter the codes in this column.

Column E: Station Location

Enter the station location in the space provided.

IMPORTANT: SAMPLERS MUST INDICATE ON EACH TRAFFIC REPORT WHETHER SAMPLING IS COMPLETE OR IF MORE SAMPLES WILL BE SHIPPED UNDER THE SAME CASE NUMBER. THIS STATEMENT CAN BE WRITTEN ANYWHERE ON THE FORM THAT DOES NOT OBSCURE NECESSARY INFORMATION, AND CAN BE AS SIMPLE A STATEMENT AS "SHIPMENT COMPLETE FOR THIS CASE" OR "MORE SAMPLES TO COME UNDER THIS CASE."



United States Environmental Protection Agency
Contract Laboratory Program Sample Management Office
PO Box 818 Alexandria, VA 22313
703-557-2490 FTS 557-2490

Organic Analysis Report
& Chain of Custody Record
(For Organic CLP Analysis)

SAS (if applicable)
NA

Case No.
17524

1. Project Code ZF3035	Account Code	2. Region No. V	Sampling Co. EAE ARCS	4. Date Shipped 1/7/92	Carrier Fed Ex
Regional Information TFA 102 Non-Superfund Program		Sampler (Name) Cathy Kouris		Airbill Number 3110833880	
Site Name		Sampler Signature Cathy Kouris		5. Ship To PACE 1710 Douglas Drive Minneapolis, MN 55422 ATTN: Paul Ernst	
City, State EIKHART, IN		3. Type of Activity SF <input checked="" type="checkbox"/> PRP <input type="checkbox"/> ST <input type="checkbox"/> FED <input type="checkbox"/> PA <input type="checkbox"/> SSI <input type="checkbox"/> LSI <input type="checkbox"/> Remedial: RIFS <input type="checkbox"/> RD <input type="checkbox"/> RA <input type="checkbox"/> O&M <input type="checkbox"/> NPLD <input type="checkbox"/> Removal: CLEM <input type="checkbox"/> REMA <input type="checkbox"/> REM <input type="checkbox"/> OIL <input type="checkbox"/> UST <input type="checkbox"/>			

6. Preservative
(Enter in Column D)
1. HCl
2. HNO₃
3. NaHSO₄
4. H₂SO₄
5. Other (SAS) (Specify)
6. Ice only
N. Not preserved

7. Sample Description
(Enter in Column A)
1. Surface Water
2. Ground Water
3. Leachate
4. Rinsate
5. Soil/Sediment
6. Oil (SAS)
7. Waste (SAS)
8. Other (SAS) (Specify)

CLP Sample Numbers (from labels)	A Enter # from Box 7	B Conc. Low Med High	C Sample Type: Comp / Grab	D Preservative from Box 6	E RAS Analysis				F Regional Specific Tracking Number or Tag Numbers	G Station Location Number	H Mo/Day/Year/Time Sample Collection	I Sampler Initials	J Corresp. CLP Inorg. Samp. No.	K Designated Field QC
					VOA	BNA	Pea/PCB	High ARO/TOX						
EPP17	5	L	G	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		130626-28	B20C(5-65)	1/7/92 805		MEJK06	
EPP18	5	L	G	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		130629-31	B20E(10-124)	1/7/92 830		MEJK07	D- EPP18
EPP19	5	L	G	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		130632-35	B20E(10-124)	1/7/92 830		MEJK08	Field Duplicate
EPP20	5	L	G	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		130636-38	B21(10-124)	1/7/92 915			
EPP21	2	L	G	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		130639-40	RMW115-01	1/7/92 1005		MEJK09	
EPP21	2	L	G	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		130641-42	RMW115-01	1/7/92 1005		MEJK09	P- EPP21
EPP22	2	L	G	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		130643-44	RMW115-01	1/7/92 1005		MEJK10	Field Duplicate
EPP22	2	L	G	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		130645-46	RMW115-01	1/7/92 1005		MEJK10	Field Duplicate
EPP23	4	L	G	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		130647-48	RMW115-01	1/7/92 1115		MEJK11	Field Blank
EPP23	4	L	G	6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		130649-50	RMW115-01	1/7/92 1115		MEJK11	Field Blank

Shipment for Case complete? (Y/N)

Page 1 of 1

Sample used for a spike and/or duplicate

Additional Sampler Signatures

Chain of Custody Seal Number

EPP17, EPP21

it this is the sample for MS/MSD

175654-55

CHAIN OF CUSTODY RECORD for MS/MSD more sample bottles

Relinquished by: (Signature) Cathy Kouris	Date / Time 1/7/92 1830	Received by: (Signature)	Relinquished by: (Signature) would be collected	Date / Time than this	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Received by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	Is custody seal intact? Y/N/none

93ZF03

CHAIN OF CUSTODY RECORD

230 North Dearborn
Chicago, Illinois 60604

[illegible]

... .. White — Arrangement Shipment; Pink — Coordinator Field File; Yellow Laboratory File

Plastic Seals 1636-54

Case # or Project Code 1	Sample Number 2	Month/Day/Year 3	Time 4	DESIGNATE	
				Comp	Grab
Station Number and Location 6				7 Samplers (signatures)	
PRESERVATIVE: H ₂ SO ₄ <input type="checkbox"/> HCL <input type="checkbox"/> HNO ₃ <input type="checkbox"/> NaOH <input type="checkbox"/> Other <input type="checkbox"/> 8				ANALYSES VOA METALS ABN CYANIDE PEST/PCB 9 Mercury Pesticides Fluoride Herbicides Nitrate/Nitrite PCB TOC PCDD/PCDF BOD 2,3,7,8-TCDD COB Ames Mutagen TDS Asbestos TSS Phosporus O&G TO1 Sulfate TO2 Chloride Sulfide TOX Ammonia CBOD Alkalinity Bio-Acute Acidity Bio-Chronic TKN	
Tag Number 5-198823				Lab Sample Number	
Remarks: 10				USE FOR MS/MSD <input type="checkbox"/> 11	

Case # or Project Code 243035	Sample Number CRMW115-01	Month/Day/Year 11/7/92	Time 1005	DESIGNATE	
				Comp	Grab <input checked="" type="checkbox"/>
Station Number and Location CRMW115-01				7 Samplers (signatures) <i>Cathy Kouri</i>	
PRESERVATIVE: H ₂ SO ₄ <input type="checkbox"/> HCL <input type="checkbox"/> HNO ₃ <input checked="" type="checkbox"/> NaOH <input type="checkbox"/> Other <input type="checkbox"/>				ANALYSES VOA METALS ABN CYANIDE PEST/PCB Mercury Pesticides Fluoride Herbicides Nitrate/Nitrite PCB TOC PCDD/PCDF BOD 2,3,7,8-TCDD COB Ames Mutagen TDS Asbestos TSS Phosporus O&G TO1 Sulfate TO2 Chloride Sulfide TOX Ammonia CBOD Alkalinity Bio-Acute Acidity Bio-Chronic TKN	
Tag Number 5-198824				Lab Sample Number	
Remarks: CASE: 17524 MEK 09				USE FOR MS/MSD <input type="checkbox"/>	



United States Environmental Protection Agency
Contract Laboratory Program Sample Management Office
PO Box 818 Alexandria, VA 22313
703-557-2490 FTS 557-2490

Special Analytical Services
Packing List/Chain of Custody

SAS NO.

6422E

1. Project Code ZF3055	Account Code	2. Region No. IV	Sampling Co. ELE ARCS	4. Date Shipped 1/7/92	Carrier Fed Ex	6. Sample Description (Enter in Column A) 1. Surface Water 2. Ground Water 3. Leachate 4. Rinseate 5. Soil/Sediment 6. Oil 7. Waste 8. Other (Specify)	7. Preservative (Enter in Column C) 1. HCl 2. HNO ₃ 3. NaHSO ₄ 4. H ₂ SO ₄ 5. NaOH 6. Other (SAS) (Specify) 7. Ice only N. Not preserved
Regional Information TFA 102		Sampler (Name) Cathy Kouris		Airbill Number 3110834053			
Non-Superfund Program		Sampler Signature Cathy Kouris		5. Ship To CENEC 1401 Municipal Rd Roanoke, VA 24012			
City, State		3. Type of Activity Lead <input type="checkbox"/> RIFS <input type="checkbox"/> CLEM <input type="checkbox"/> SF <input type="checkbox"/> PA <input type="checkbox"/> RD <input type="checkbox"/> REMA <input type="checkbox"/> PRP <input type="checkbox"/> RA <input type="checkbox"/> REM <input type="checkbox"/> ST <input type="checkbox"/> SS <input type="checkbox"/> O&M <input type="checkbox"/> OIL <input type="checkbox"/> FED <input type="checkbox"/> LSI <input type="checkbox"/> NPLD <input type="checkbox"/> UST <input type="checkbox"/>		ATTN: B HUTCHENSON			

Sample Numbers	A Matrix Enter from Box 6	B Conc Low Med High	C Preserv- ative Used from Box 7	D Analysis	E Regional Specific Tracking Number or Tag Number	F Station Location Identifier	G Mo/Day/ Year/Time Sample Collection	H Sampler Initials	I Designated Field QC
1. E-01	2	L	7	BOD	130759	CRMW025-02	1/7/92 1005		
2. E-01	2	L	4	COD	130760	CRMW025-02	1/7/92 1005		
3. E-02	2	L	7	BOD	130761	CRMW025-02	1/7/92 1005		
4. E-02	2	L	4	COD	130762	CRMW025-02	1/7/92 1005		
5. E-03	2	L	7	BOD	130763	CRMW235-01	1/7/92 1115		
6. E-03	2	L	4	COD	130764	CRMW235-01	1/7/92 1115		
7. E-04	2	L	7	BOD	130765	CRMW01B-01B	1/7/92 1300		Field Blank
8. E-04	2	L	4	COD	130766	CRMW01B-01B	1/7/92 1300		Field Blank
9.									
10.									
Shipment for SAS complete? (Y/N)		Page 1 of 1		Sample Used for Spike and/or Duplicate E-03		Additional Sampler Signatures		Chain of Custody Seal Number 175672-73	

CHAIN OF CUSTODY RECORD

Relinquished by: (Signature) Cathy Kouris	Date / Time 1/7/92 1830	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Received by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	Is custody seal intact? Y/N/none

EPA Form: 8110-3 (7/91)
DISTRIBUTION:

Split Samples ☐ Accepted (Signature)
☐ Declined



United States Environmental Protection Agency
Contract Laboratory Program Sample Management Office
PO Box 818 Alexandria, VA 22313
703-557-2490 FTS 557-2490

Inorganic Traffic Report & Chain of Custody Record

(For Inorganic CLP Analysis)

SAS No. (if applicable) **NA**
Case # **175**

1. Project Code TF3035	Account Code	2. Region No. IV	Sampling Co. E&E ARCS	4. Date Shipped 1/7/92	Carrier Fed Ex	6. Preservative (Enter in Column D) 1. HCl 2. HNO3 3. NaOH 4. H2SO4 5. K2Cr2O7 6. Ice only 7. Other (SAS) (Specify) N. Not preserved	7. Sample Description (Enter in Column A) 1. Surface Water 2. Ground Water 3. Leachate 4. Rinse 5. Soil/Sediment 6. Oil (SAS) 7. Waste (SAS) 8. Other (SAS) (Specify)
Regional Information TFA 102		Sampler (Name) Cathy Kouris		Airbill Number 3110833891			
Non-Superfund Program		Sampler Signature Cathy Kouris		5. Ship To KEYTX			
Site Name		4. Type of Activity Lead <input type="checkbox"/> Remedial <input checked="" type="checkbox"/> RIFS <input type="checkbox"/> RD <input type="checkbox"/> RA <input type="checkbox"/> O&M <input type="checkbox"/> NPLD <input type="checkbox"/> CLEM <input type="checkbox"/> REMA <input type="checkbox"/> REM <input type="checkbox"/> OIL <input type="checkbox"/> UST <input type="checkbox"/>		8300 West Park Dr. Houston, TX 77063			
City, State		Site Split ID		ATTN: DeLa Massoudi			

CLP Sample Numbers (from labels)	A Enter # from Box 7	B Conc. Low Med High	C Sample Type: Comp / Grab	D Preservative from Box 6	E - RAS Analysis								F Regional Specific Tracking Number or Tag Numbers	G Station Location Number	H Mo/Day/Year/Time Sample Collection	I Sampler Initials	J Corresp. CLP Org. Samp. No.	K Designated Field QC
					Metals		Low Conc.		High									
					Total	Dissolved	Chloride	Nitrate	Nitrite	Fluoride	pH	Conductivity						
MEJK06	5	L	G	N	X		X						130709	B20C(5-6.5H)	1/7/92 805	EPP17		
MEJK07	5	L	G	N	X		X						130710	B20E(10-12H)	1/7/92 830	EPP18	MEJK07	
MEJK08	5	L	G	N	X		X						130711	B20E-D(10-12H)	1/7/92 830	EPP19	Field Duplicate	
MEJK09	2	L	G	2	X								130712	CRMW115-01	1/7/92 1005	EPP21		
MEJK09	2	L	G	3			X						130713	CRMW115-01	1/7/92 1005	EPP21	MEJK09	
MEJK10	2	L	G	2	X								130714	CRMW115-01	1/7/92 1005	EPP22	Field Duplicate	
MEJK10	2	L	G	3			X						130715	CRMW115-01	1/7/92 1005	EPP22	Field Duplicate	
MEJK11	4	L	G	2	X								130716	CRMWFB-01	1/7/92 1115	EPP23	Field Blank - B	
MEJK11	4	L	G	3			X						130717	CRMWFB-01	1/7/92 1115	EPP23	Field Blank - B	

Shipment for Case complete? (Y/N) (N)	Page 1 of 1	Sample used for a spike and/or duplicate MEJK06, MEJK09	Additional Sampler Signatures additional bottles/ 75658-59	Chain of Custody Seal Number would need to be collected
--	--------------------	---	--	---

Relinquished by: (Signature) Cathy Kouris	Date / Time 1/7/92/1830	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Received by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	Is custody seal intact? Y/N/none

SAMPLER INSTRUCTIONS FOR USE OF
MULTI-SAMPLE ORGANIC AND INORGANIC TRAFFIC REPORTS
HORIZONTAL FORMAT
EPA FORM #9110-1 (INORGANICS) AND
FORM 9110-2 (ORGANICS)

1/20/89

A. Introduction - Samples and Sample Numbers

The Contract Laboratory Program (CLP) Organic and Inorganic Multi-Sample Traffic Reports (TRs) document samples shipped to CLP laboratories. You must use TRs each time you ship Routine Analytical Services (RAS) samples to a CLP laboratory. The new horizontal version of the multi-sample TRs may document up to 20 samples shipped to one CLP laboratory under one Case Number and RAS analytical program.

CLP sample types are defined by the RAS analytical program. There are currently three organic/inorganic programs: inorganic, organic, and fast-turnaround VOAs. Inorganic samples may be analyzed for Total Metals, Cyanide or both. Organic samples may be analyzed for Volatile Organics (VOAs), Base/Neutral/Acid (BNAs), Pesticide/PCBs, or any combination of these. VOA-Only samples are in a separate program from organics because of the faster turnaround provided. Inorganic samples are documented on Inorganic TRs. Organic and VOA-Only samples are documented on Organic TRs.

A CLP sample is one matrix — water or soil — never both. The CLP sample is further defined as consisting of all the sample aliquots from one station location, for each matrix and RAS analytical program. For example, let's say you were sampling at Pond A. You plan to collect one water sample and one soil/sediment sample, each to be analyzed for VOAs, BNAs, Pesticide/PCBs, Total Metals and Cyanide. All the bottles for the organic water analyses at this station — VOA vials, BNA jars, and Pesticide/PCB jars — make up one organic CLP sample, not three. All of the bottles for the organic soil analysis — VOA vials and BNA/Pesticide/PCB jars — make up the second organic CLP sample. The bottles for inorganic water analysis at this station — one for Total Metals and one for Cyanide — make up one inorganic CLP sample, not two. The bottle for inorganic soil analysis makes up the second inorganic CLP sample from Pond A. Even though you have collected a water and a soil for five different analyses from Pond A, you've collected four CLP samples — an organic water, an organic soil, an inorganic water and an inorganic soil.

The CLP generates unique Sample Numbers which must be assigned to each organic, VOA-Only, and inorganic sample. The unique CLP Sample Numbers are printed on the adhesive labels. It is your responsibility to assign this critical Sample Number correctly and to transcribe it accurately on the TR.

If the organic sample will be split between a 14 day VOA-only lab and a RAS organic lab, two CLP sample numbers for each sample must be used. The VOA only lab sample would have one number and the ABN/Pesticides/PCBs sample fraction would be assigned another number. A good rule of thumb is one sample number per sample per lab.

Organic and VOA-Only Sample Numbers are in the format XX123, and have ten labels per strip: four for extractables, two for VOAs, and four blank (extra). (See Attachment 1.) DESTROY THE UNUSED LABELS to prevent duplication of Sample Numbers.

Inorganic Sample Numbers are in the format MOOX123 and have seven labels per strip: two for Total Metals, two for Cyanide and three extra (see Attachment 1). Remember that the unique Sample No. must only be used once. DESTROY THE EXTRA

Use only the labels provided to the Region in which you are sampling. CLP Sample Numbers are alphabetically coded to correspond with each Region as follows:

Letter Code			Letter Code		
Organic	Inorganic	Region	Organic	Inorganic	Region
A	MA	I	F	MF	VI
B	MB	II	G	MG	VII
C	MC	III	H	MH	VIII
D	MD	IV	Y	MY	IX
E	ME	V	J	MJ	X

REMEMBER:

- o TRs must be used for each Case No. with every shipment of samples to each CLP laboratory.
- o Organic samples, VOA-Only samples, and inorganic samples are assigned separate, unique Sample Numbers. Each sample consists of all the sample aliquots from a sample station location for analysis in one of the three analytical programs.
- o A CLP RAS sample will be analyzed as either a water or a soil sample.
- o Prevent accidental duplication of Sample Numbers by destroying unused labels.
- o Use only the Sample Numbers specific to your Region.
- o The samplers must indicate on each Traffic Report whether shipment is complete.

B. Completing the Form - Case Documentation
(Attachments 2 & 3)

Enter the Case No. and SAS No. (if applicable) at the top right of the form. Complete the boxes in the header:

Box No. 1:

Type of Activity:

If sampling is under Superfund, circle the code which describes the task of the sampling mission:

ENF	- Enforcement	RD	- Remedial Design
ER	- Emergency Response (Removal)	RIFS	- Remedial Investigation Feasibility Study
ESI	- Expanded Site Investigation	SI	- Site Investigation
NPLD	- National Priorities List Delem	ST	- State Lead
O + M	- Operations and Maintenance	STPA	- State Lead Assessment
PA	- Preliminary Assessment	STSI	- State Lead Site Investigation
RA	- Remedial Action	Other	- Please Specify

If sampling is not under the Superfund program, enter the name of program, e.g., RCRA.

Enter the site name, the city, state, and Site Spill ID in the designated spaces.

Box No. 2:

Regional Information:

Enter the Region number, the name of your sampling company, and your name in the designated spaces.

Box No. 3:

Ship To:

Enter the name of the CLP laboratory and its full address in the box. Enter the name of the sample custodian or CLP contact in the box provided.

Box No. 4:

Shipping Information:

Enter the date shipped, the carrier code (e.g., F = Federal Express, P = Purolator, etc.) and the airbill number in the appropriate spaces.

**C. Completing the Form - Sample Documentation
(Attachments 2-3)**

Carefully transcribe the CLP Sample No. from the printed sample labels on the TR in the space provided.

Complete columns A through G to describe the sample:

Column A, Sample Description:

Enter the appropriate sample description code from Box 5. NOTE: Describe BLANKS as #3 "Leachate" in Column A. Write the word "Blank" in Column D, the Special Handling section. Note: Item #6 "Oil" and Item #7 "Waste" are for RAS PLUS SAS projects only. Do not ship oily samples or waste samples without making prior arrangements with SMO.

Column B, Concentration:

Organic - If sample is estimated to be low or medium concentration, enter "L". When shipping RAS Plus SAS high concentration samples (previously arranged with SMO), enter "H".

Inorganic - Enter "L" for low concentration, "M" for medium concentration, and "H" for high concentration (under previous RAS Plus SAS arrangement).

REMINDER: Ship medium and high concentration organic and inorganic samples in metal cans.

Column C: RAS Analysis:

Check the analytical fractions requested on each sample.

Column D: Special Handling:

Use this space to specify any special handling requirements. Blank samples should be identified as such in this space. When shipping RAS Plus SAS samples you may code SAS parameters in the blank space (e.g., A = sulfate, B = Cl, etc.) and enter the codes in this column.

**D. Instructions on the Reverse
(Attachments 4-5)**

Instructions summarizing CLP sample volumes, packaging and reporting requirements are printed on the back of the TR.

[illegible]

[illegible]

C-12

CHAIN-OF-CUSTODY FORM

1. Enter your project # or the first six digits of the CRL log number. (see page C-20).
2. Enter the case number or SAS number (do not enter the site name).
3. Obtain the full signature of sample team leader.
4. Enter the traffic report sample number or the SAS sample number.
5. List sampling dates for all samples.
6. List sampling times for all samples.
7. Indicate "grab", "composite" sample with an "X".
8. List station locations and other information. i.e., 'blank', use for the MS/MSD, etc.
9. Enter number of containers per sample and container volume (e.g., 2-40 ml).
10. List analyses individually. (VOA, ABN, PEST/PCB, MET, CN, etc.; for soils, metals and cyanide are taken from the same container, therefore the MET & CN should be together in one column.)
11. Construct column heading for "tag number" and list tag numbers for each sample container.
12. Obtain signature of sample team leader and carry out chain of custody procedures.
13. State carrier service and air bill number, lab service, and custody seal numbers are written here.

NOTE:

One Chain-Of-Custody should be filled out per shipping container. The purpose of using site code is to prevent the contract laboratory from obtaining the site name. An alternative to using a site code is to separate the copies and write the site name on your copy and the Region's copy, leaving that field blank on the lab's copy.

THIS IS A THREE COPY FORM:

The top copy goes to the CRL or CLP laboratory with the samples. The second copy (pink) goes to SMO if the samples are going to the CLP. The last copy (yellow) goes to the RSCC with other paperwork for the site (for samples shipped to the CLP).

(continued)

CHAIN OF CUSTODY FORM (continued)

If numbered CDC seals are not available from Region V, then the alternate CDC seal (a white seal that needs to be signed and dated upon use) should be used. In this case, a note should be made on the CDC form indicating that these seals were used instead of the numbered seals.

For samples coming to the CRL for analysis, the site name should be entered. The CRL log number should be used to identify the sample (instead of the traffic report number), as well as the tag number and analyses requested.

Also, list the QC bottle lot numbers in the remarks area if you are not tracking this on your sampling matrix.

REGION 6
230 South Dearborn Street
Chicago, Illinois 60604,

[illegible]

05-01657

CENTRAL REGIONAL LABORATORY SAMPLE DATA REPORT (CRL-SDR)

1. Insert assigned laboratory case number.
2. Insert site name.
3. Insert laboratory names, indicating which lab will receive the organic samples and which lab will receive the inorganic samples.
4. Insert date of shipment.
5. Insert DU code (either TFA102 for site inspection or remedial, or TGB102 for enforcement, including PRP sites).
6. Insert name of RPM (the RPM will know what the site DU code is).
7. Enter the Cerclis number.
8. Insert page number and total number of pages.
9. Enter the site/spill ID code (a 2 digit preassigned EPA code).
10. Insert CRL log number, which consists of the fiscal year, EPA assigned contractor code, sample type designation and sample number.

Example: 8 9 Z A 0 1 S 0 1
 a b c d e

a.	b.	c.	d.	e.
FY -	contractor	this should	sample type	sample
Fed.	code	be a sequential	S-sample	number
Fiscal		number	D-duplicate	
(Oct.-Sept.)		i.e..01.02.	R-field or	
		03.etc.	trip blank	

89ZA01S01 would be a sample.
89ZA01D01 would be a field duplicate of sample 89ZA01S01.
89ZA01R01 would be a field blank.

11. Insert organic traffic report number.
12. Insert inorganic traffic report number.
13. Indicate the analyses required (eg. acid-base neutral cpds., volatile organic analysis, etc.) for each sample in the appropriate section (for waters or soils) with an "X".

Note: All samples should have a unique number. If a sample is collected for filtered and unfiltered metals analyses, a separate ITR should be filled out for each bottle(the filtered and unfiltered). Each one of these samples would then be assigned a unique CRL log number. In order to distinguish between the filtered and unfiltered samples, they can be listed on the CRL-SDR with a column heading indicating 'filtered metals'.

(continued)

Central Regional Laboratory Sample Data Report (continued)

THIS IS A SINGLE COPY FORM:

This form must be filled out for all SF samples which will go to contract labs and must be sent to the Region V RSCC with the other paperwork required for a site. A copy must also be sent to SMO with the TRs and the COCs.

The contractor codes list below should be consulted when generating the CRL log number. A minimum of approximately 10,000 unique CRL log numbers can be generated for each contractor per fiscal year using this numbering system.

<u>Contractor</u>	<u>Code</u>
REM II	R
REM III	VA
REM IV	H
REM V	VB
ARCS/Other	
Warzyn	ZA
Black & Veatch	ZB
CH2	ZC
Donahue	ZD
E&E	ZE
PRC	ZF
Weston	ZG
UV Science	ZH
EPA Personnel	S
RCRA	K
TES	J
TAT	VT
FIT	F
MDNR	M
WDNR	X
MPCA	Y

THIS FORM IS TO BE USED FOR SAMPLES SENT TO CONTRACT ONLY

[illegible]

**DIOXIN SAMPLE DOCUMENTATION
AND SHIPMENT INSTRUCTIONS**

July 1988

Instructions for Completing DSR Form

A separate Dioxin Shipment Record (DSR) form is to be completed for each shipment of samples to a laboratory. First, enter the Case number on the top right corner of the DSR form, where indicated. The Case number is the identifying number that was assigned by SMO at the time the sampling was scheduled. This is followed by the Batch number, which is assigned by the sampler when samples are packed for shipment to the laboratory.

The Batch number represents one shipment of up to twenty-four (24) samples from one specific location to one laboratory on one day and is assigned sequentially. For example, the first shipment of samples in a Case would be identified as Batch #1, the second shipment would be Batch #2, etc. When sampling occurs over several days, care must be taken not to repeat Batch numbers within the Case.

The use of Batch numbers allows for identification of groups of samples within a Case that are shipped to different laboratories and/or that are shipped on different days. The Batch number may also be used to signify a group of samples collected at a specific location within the overall site perimeter, should the site encompass a large geographical area.

Next, complete header information, excluding the areas on the top right of the form that are set off by bold lines. These areas are for laboratory use.

NEW INSTRUCTIONS WILL BE PROVIDED WHEN THE FORM IS REVISED.

USEPA Contract Laboratory Program
 Service Management Office
 P.O. Box 818 Alexandria, Virginia 22313
 PHS 8-557-2490 703/557-2490

CASE NO: <u>7000</u>	BATCH NO: <u>01</u>
EAS NO: <u>N/A</u>	

CLP DIOXIN SHIPMENT RECORD

Site Name: RUSTY DRUM SITE	Region Number: <u>IV</u>	Site ID: <u>True Value Analytical</u>
City & State: <u>Rustville, Fla.</u>	Sampling Contact: <u>Joe Sampler / Lawson</u>	<u>Tulsa, OK</u>
EPA Sub Plant Label: <u>24</u>	(Name) / (Company)	Date Shipped: <u>1/16/87</u>
File: <u>1234567</u> (circle one)	Sampling Date: <u>1/15/87</u>	

Instructions: 1) Ship all samples in Nation Level, in order case.
 2) Send primary samples in VCI or brown organic solvents.
 3) Sample Description: Soil/Sediment, 4 ea./sample in glass jar
 4) 1 liter/soil in amber glass. Send one 4 liter
 container each for top QC.

Sample Number	MATRIX (check one/sample)					DESCRIPTION		EAS ONLY	
	SOIL/ SEDIMENT	AQUEOUS	EQUIP RIMS (ORG SOLV) OTHER	(SAS ONLY)	SAMPLE TO CHILLER	SAMPLE TO DUPLICATE	SAMPLE LOCATION for other field desc	SPECIFY ADDITIONAL SAS ANALYSIS	PARAMETERS
DD011201	X						D01-1		
DD011202	X						D01-2		
DD011203	X						D01-3		
DD011204	X						D02-1		
DD011205	X						D02-1a		
DD011206			X				D02-2		
DD011207	X						D02-3		
DD011208	X				X		D03-1		
DD011209	X						D03-2		
DD011210	X						D03-3		
DD011211	X						D04-1		
DD011212	X					X	D04-2		
DD011213	X						D04-3		
DD011214	X						D05-1		
DD011215	X						D05-2		
DD011216	X						D06-1		
DD011217	X						D06-2		
DD011218	X						D06-3		
DD011219	X						D07-1		
DD011220	X						D07-2		
DD011221	X						D07-3		
DD011222		X			X		D08-1		
DD011223		X				X	D08-2		
DD011224		X					D08-3		

WHITE—SNO Copy YELLOW—Region Copy PINK—Lab Copy or Return to SNO GOLD—Lab Copy

ENVIRONMENTAL PROTECTION AGENCY
Central Regional Laboratory Analysis Request Form

1. Insert sampler name, i.e., CDM, Flt. E&E, Weston, or RPM name.
2. Insert sampling date.
3. Insert DU number (Y905 or Y306).
4. Insert site name.
5. Insert priority code (if any).
6. Insert CRL log numbers (see page C-20).
7. Insert sample tag number.
8. Indicate analyses required by placing an "X" in the appropriate column for each sample.

Note: The analytes that are routinely analyzed for at the Central Regional Laboratory are listed in Appendix F which was included in the Transmittal of Latest CRL Method Capabilities and Requirements, sent from the CRL Quality Control Coordinator on February 23, 1987 to All Superfund Sample Requestors and QAPP Preparers.

- * Normal turnaround time for the CRL is 21 days from receipt of samples. Priority 1 analysis requires a 5 day turnaround, and must be requested via a memo from the WMD Director to the ESD Director in advance of sampling.
- Requests for shorter than the 21 day (and greater than 5 days) turnaround must be addressed to the CRL Director.

DIVISION/BRANCH _____ SAMPLE DATE _____ LAB ARRIVAL DATE _____ DUE DATE _____
 DU NUMBER _____ DATA SET NUMBER _____ STUDY _____ PRIORITY _____ CONTRACTOR _____

C-2

Appendix D

**Contract Laboratory Program Sample Collection Requirements
For Routine Waters and Soils, High Hazard Liquids and Solids
and Dioxin Samples**

**D-1
through
D-3**

**CLP Sample Collection Requirements For Routine
Water and Soil Samples for Organics and Inorganics
Low, Medium and High Concentration and Dioxin Samples**

ANALYSIS	REQUIRED VOLUME	# OF CONTAINERS	CONTAINER TYPE	PRESERVATIVE
<hr/>				
<u>WATER SAMPLES</u>				
Metals-low level (Hg included)	1 liter	1	1 liter polyethylene bottle	HNO ₃ to a pH<2
*Metals-medium level (Hg included)	1 liter	1	16 oz. wide wide mouth bottle	HNO ₃ to a pH<2
Cyanide- low level	1 liter	1	1 liter polyethylene bottle	NaOH to a pH>12 Cool, 4° C **1.2g ascorbic acid
*Cyanide-medium level	1 liter	1	1 16 oz. wide wide mouth bottle	NaOH to a pH>12 Cool, 4° C **1.2g ascorbic acid
Extractables-low level	1 gallon	2 or 4	80 oz. amber glass bottles 1 liter amber glass bottles	Cool, 4° C
*Volatile-low or medium level	80 ml	2	40 ml glass vials	Cool, 4° C. Preserve low level samples with 1-2 drops HCl to pH<2. Samples must be free of headspace.
<hr/>				
<u>SOIL SAMPLES</u>				
*Metals and cyanide, low or medium level	6 oz.	1 or 2	6 oz. wide mouth glass bottles 4 oz. wide mouth glass bottles	
*Extractables-low or medium level	6 oz.	1 or 2	6 oz. wide mouth glass bottles 4 oz. wide mouth glass bottles	Cool, 4° C
*Volatiles-low or medium level	240 ml	2	120 ml wide mouth glass vial	Cool, 4° C: vial must full and free of headspace

Sample collection Requirements (continued)

ANALYSIS	REQUIRED VOLUME	# OF CONTAINERS	CONTAINER TYPE	PRESERVATIVE
<hr/>				
<u>HIGH HAZARD SAMPLES</u>				
*Liquid Samples- organic and inorganic	4 oz.	2	4 oz. wide mouth glass bottle	Note: One bottle is for inorganics. the other is for organics
*Solid Samples- organic and inorganic	4 oz.	2	4 oz. wide mouth glass bottle	(same as above)

DIOXIN SAMPLES

*2,3,7,8-TCDD	4 oz.	1	4 oz. wide mouth glass bottle
---------------	-------	---	-------------------------------------

* All medium level, high hazard, and dioxin samples must be sealed in metal paint cans for shipment. The outer metal can must be labeled with the number of samples contained inside.

** Should only be used in the presence of residual chlorine.

All low level sample containers must be enclosed in clear plastic bags before placing in the cooler for shipment.

All samples should be shipped in ice chests packed with non-combustible, absorbent packing material (vermiculite) surrounding the plastic enclosed sample bottles (or metal cans containing samples).

Traffic Reports, Dioxin Shipment Records, SAS Packing Lists, Chain of Custody Records and any other shipping/sample documentation accompanying the shipment must be enclosed in a waterproof plastic bag and taped to the underside of the cooler lid.

Coolers must be sealed with Region V numbered custody seals in such a manner that the custody seals would be broken if the cooler were opened. Water proof tape must cover the custody seals.

Water samples for organic matrix spike/matrix spike duplicate analysis must be collected at double the volume specified for Extractables and triple the volume specified for Volatiles.

The RAS/SOWs require lab QC (MS/MSD for organics, a spike and a duplicate for inorganics) to be done at a frequency of one set of QC for each 20 samples (or less) of the same matrix in each Case. (It is important that the traffic reports contain a statement indicating whether sample shipment is complete or if more samples will be coming to the lab under that Case number so that the lab can proceed with the analyses.) If more than 20 water samples are

CLP Sample Collection Requirements (continued)

collected for a Case, extra volume for the MS/MSD analyses must be collected for every group of 20 organic samples or less.

For water and soil samples, field blanks and duplicates should be supplied at the frequency prescribed in the approved QAPP for the site.

No additional soil volume is required for laboratory analysis of MS/MSD (organics) or spikes and duplicates (inorganics).

The water Volatiles sample must be preserved with 4 drops of 1:1 HCl or 2 drops of concentrated HCl to a pH<2. This is due to a new CLP holding time of 10 days (instead of 7 days).

Appendix E

Central Regional Laboratory Sample Collection Requirements
For Routine Water Samples For Organics and Inorganics Analyses

E-1

CRL Water Sample Collection Requirements

ANALYSIS	REQUIRED VOLUME	# OF CONTAINERS	CONTAINER TYPE	PRESERVATIVE
Metals	1 liter	1	1 liter polyethylene bottle	HNO ₃ to a pH<2
Cyanide	1 liter	1	1 liter polyethylene bottle	NaOH to a pH>12 Cool, 4° C **Special handling if residual chlorine or sulfide is suspected
Mercury	500 ml	1	1 liter polyethylene bottle	10 ml of preservative so that final concentration is 0.05% (w/v) K ₂ Cr ₂ O ₇ and 0.5% (w/v) HNO ₃
Pest/PCB (Organics)	1 liter*	1	1 liter amber glass bottle completely full	Cool, 4° C
Acid/Base/ Neutral (organics)	1 liter*	1	1 liter amber glass bottle completely full	Cool, 4° C
Volatile Organics	120 ml	3	40 ml glass vials	Cool, 4° C Samples must be free of headspace.

* A total of three 1 liter bottles is required per sample if ABN and Pest/PCBs are requested. The extra bottle is used for re-extraction, if necessary.

Note: A total of 8 1 liter bottles is required for the sample chosen for the Matrix Spike and Matrix Spike Duplicate analysis of ABN and Pest/PCBs.

A total of 8 vials is required for the sample chosen for the Matrix Spike and Matrix Spike Duplicate analysis of volatiles.

No extra volume is required for the spike and duplicate analysis of metals, cyanide and mercury, however, the sampler should indicate on the sample tags which samples should be used for the lab duplicate and lab spike analysis.

Mercury Preservative: Dissolve 250ml of concentrated HNO₃ and 25g of K₂Cr₂O₇ in deionized distilled water and dilute to one liter. Collect approximately 500ml of sample and add 10ml of this preservative.

Caution: Do not store the preservative solution in plastic containers.

Appendix F

Residential Well Sample Collection Requirements for CRL and CLP

F-1

Residential Well Sample Collection Requirements For CRL and CLP

ANALYSIS	REQUIRED VOLUME	# OF CONTAINERS	CONTAINER TYPE	PRESERVATIVE
Metals	1 liter	1	1 liter polyethylene bottle	HNO ₃ to a pH<2
Cyanide	1 liter	1	1 liter polyethylene bottle	NaOH to a pH>12 Cool. 4° C **Special handling if residual chlorine or sulfide is suspected
Mercury	500 ml	1	1 liter polyethylene bottle	10 ml of preservative so that final concentration is 0.05% (w/v) K ₂ Cr ₂ O ₇ and 0.5% (w/v) HNO ₃
Pest/PCB (Organics)	1 liter*	1	1 liter amber glass bottle completely full	Cool. 4° C
Acid/Base/ Neutral (organics)	1 liter*	1	1 liter amber glass bottle completely full	Cool. 4° C
Volatile Organics	120 ml	3	40 ml glass vials	Cool. 4° C Samples must be free of headspace.

* A total of three 1 liter bottles is required per sample if ABN and Pest/PCBs are requested. The extra bottle is used for re-extraction, if necessary.

Note: A total of 8 1 liter bottles is required for the sample chosen for the Matrix Spike and Matrix Spike Duplicate analysis of ABN and Pest/PCBs.

A total of 8 vials is required for the sample chosen for the Matrix Spike and Matrix Spike Duplicate analysis of volatiles.

No extra volume is required for the spike and duplicate analysis of metals, cyanide and mercury, however, the sampler should indicate on the sample tags which samples should be used for the lab duplicate and lab spike analysis.

Mercury Preservative: Dissolve 250ml of concentrated HNO₃ and 25g of K₂Cr₂O₇ in deionized distilled water and dilute to one liter. Collect approximately 500ml of sample and add 10ml of this preservative.

Caution: Do not store the preservative solution in plastic containers.

APPENDIX B

GENERAL FIELD SAMPLING PROCEDURES

ATMOSPHERIC SAMPLING FOR VOLATILE ORGANIC COMPOUNDS

1.0 INTRODUCTION

This procedure outlines a methodology which may be used to collect environmental samples for determining the concentration of volatile organic contamination in ambient air. During sample collection, a known volume of contaminated air is drawn through a sorbent collection tube by a personal sampling pump. The volatile organics collected on the sorbent are desorbed either chemically or thermally and the resulting sample is analyzed by a gas chromatograph or a coupled gas chromatograph/mass spectrometer. This procedure can produce both quantitative and semi-quantitative analytical results for assessing the concentration of volatile organic contamination in the ambient atmosphere.

2.0 EQUIPMENT

1. Personal low flow sampling pumps (one per sample location)
2. Tygon tubing (approximately 2 inches)
3. Sample collection tubes packed with Tenax-GC sorbent material or activated charcoal (packed in VOA vials)
4. Buck primary standard mass flowmeter
5. Air contaminant monitoring data sheet
6. Field notebook
7. Shipping container
8. Dry ice
9. Barometer
10. Sling psychrometer

11. Thermometer

12. Stop watch

3.0 PREPARATORY ACTIVITIES

To ensure that the appropriate analysis is performed for the collected samples, contact with the specific laboratory performing the analysis should be made prior to the sample collection event. Detection levels for specific compounds are dependent upon sorbent material, sample collection volume and specific analytical procedures. Therefore, in order to meet the specific objectives of the sampling program, it is important to coordinate the sample collection and analytical procedures.

Prior to the initiation of the field program, a determination of the appropriate sorbent material should be made. Please consult with appropriate laboratory personnel when making this decision. Either Tenax-GC sorbent or activated charcoal should be used for most sample collection. Physical dimensions of the tubes will vary between laboratories because of the different configurations of thermal desorption systems. Specific sample collection tubes should be prepared and obtained from the laboratory which will perform the specific analysis requested. Tubes will be provided by the laboratory free of contamination and certified for sample collection. Tubes should be stored in sealed VOA vials or other suitable sealed container until used for sampling. Blank tubes must accompany each "lot" of tubes to determine external contamination.

4.0 PROCEDURES

4.1 Before sampling, obtain barometric pressure, relative humidity and ambient temperature readings using a barometer, sling

psychrometer and thermometer, respectively (Procedure 5607008). Record appropriate values in both the air contaminant monitoring data sheet and the field notebook.

4.2 Assemble sample collection device in the following manner:

1. Set pump on low flow mode (see SKC instructions) by turning the pressure regulator valve on. Use orifice if necessary to obtain exact flow.
2. Connect exit portion of the sample tube to the intake portion of the personal sampling pump by removing the plastic end cap and connecting with Tygon tubing. The exit portion of the sample collection tube is designated by a flow arrow on the side of the tube. Leave plastic cap on the other end of the sample tube.
3. Record identification numbers of both the sample collection tube and the personal sampling pump onto both the air contaminant monitoring data sheet and the field notebook.

4.3 A sample size for a total volatile organic compound screen should be between 15 and 30 liters of sample air. The flow rate should be approximately 1.0 liters per minute or less. The corresponding sample collection time can be calculated. Using the Buck primary standard mass flowmeter, measure the sample velocity by the following method:

1. Remove the plastic end cap from the sample collection tube.
2. Connect flow measurement tubing from sampling collection tube to flowmeter.
3. Turn on pump and measure flow velocity.
4. Adjust the personal sampling pump flow velocity to approximately 1 liter per minute by turning the flow adjustment screw with a screwdriver clockwise to increase flow or counterclockwise to decrease flow.
5. Measure flow again and continue adjustment process until desired flow is obtained.

6. Remove connecting tubing and place plastic cap back on sample collection tube.
- 4.4 Set pump timer to desired sampling time. Place sample collection device in desired location, remove end cap and start sample collection. Record sample collection start time, rotometer setting, and initial flow rate in both the air contaminant monitoring data sheet and the field notebook. Due to analytical instrumentation limitations all volatile samples should be collected in duplicate.
- 4.5 After the calculated sample collection time has been reached the pump will automatically shut off. Restart pump momentarily and recheck rotometer setting. If different from initial reading, measure the sampling flow velocity. Record both the sample stop time, final rotometer setting and final flow velocity in both the air contaminant monitoring data sheet and the field notebook.
- 4.6 Remove the sample collection tube from the Tygon tube and place plastic caps on both ends of the sample collection tube. Samples should then be placed in VOA vials and sealed. All samples should immediately be stored and shipped in an appropriate shipping container and packed in dry ice. The air contaminant monitoring data sheet should accompany the samples. Samples are often shipped with activated charcoal to prevent external contamination.

5.0 DECONTAMINATION

All sample collection tubes should be decontaminated and certified by the analytical laboratory. Only purged or clean tubes obtained from the laboratory prior to the sampling event are allowed to be used.

6.0 ANALYSIS AND REPORT

Results of samples collected by this method are derived by utilizing a laboratory analytical procedure. This procedure consists of thermally desorbing the collected volatile organic compounds from the sample collecting tube and analyzing the concentrations of the volatile organic compounds using a gas chromatograph/mass spectroscopy process. Thermal desorption is accomplished by heating a Tenax-GC sorbent tube or activated charcoal tube while purging it with a helium stream. Desorbed material from the cartridge is freeze trapped at liquid nitrogen temperature in a nickel capillary tube. This trap is subsequently switched into a gas chromatograph carrier stream and heated. The sample passes via a heated transfer line into a capillary gas chromatograph column and eventually to a mass spectrometer. Analytical results of samples collected during a typical event should produce detection in the parts per billion range.

7.0 SPECIAL CONSIDERATION

Collection of volatile organic compounds using a sorbent material require conducting a series of preparatory activities before performing the sampling event. Sample collection tubes need to be prepared prior to use for sample collection. This tube preparation must be performed by the laboratory which is designated to conduct the analysis. Coordination should also be made with the laboratory to identify specific sample collection and laboratory analytical technique which will ensure the integrity of the results and achieve the specific data requirements of the program.

AIR PUMP CALIBRATION SHEET

Client:

Contaminant to be Sampled:

Desired Calibration Point:

Pump ID #:

Pump ID #:

Pump Name Brand:

Pump Name Brand:

Date:

Date:

Time:

Time:

Analyst:

Analyst:

Trial	Calibration		Trial	Calibration	
	Time, sec	Volume, ml		Time, sec	Volume, ml
1			1		
2			2		
3			3		
4			4		
5			5		
$\bar{x} =$			$\bar{x} =$		

Pump Calibration:

Pump Calibration:

Description/diagram of sampling train:

SORBENT TUBE COLLECTION SHEET

Client Name _____ File Number _____

Client Address _____ Suspected Contaminant _____

Sampling Address _____

Contact _____

Telephone Number _____

Site Description			
Client Sample Number			
Lab Sample Number			
Pump I.D. Number			
Pump Calibration, l/min.			
Pump Calibration Date			
Type of Sorbent Tube			
Tube Size			
Time - Start			
Time - Finish			
Total Time, - Minutes			
Barometric Pressure, mm Hg			
Temperature, °C			
Relative Humidity, % r.h.			
Total Air Volume Samples, l			
Date of Sampling			
Sampling Personnel			
Pump Post- Calibration l/min			

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Revision: 0
Date: 4/85
Page: 1 of 5

GENERAL SOIL SAMPLING PROCEDURES

1.0 INTRODUCTION

Soil sampling is undertaken at uncontrolled hazardous waste sites and controlled substances work areas to determine the type, degree and extent of contamination resulting from previous disposal practices.

For the purposes of this document, soil is considered to be all unconsolidated materials above bedrock. Consolidated materials such as bedrock or rock outcrops are not considered soil, but may be encountered in soil borings. The procedures for rock sampling are described in document 5618003.

Soil materials which are submerged or exist beneath standing water such as in ponds or streams are considered sediments and specific procedures for obtaining sediment samples are described in Procedure 5614005.

Soils may have variable characteristics depending upon their texture, structure and moisture content. The selection of optimum sampling techniques and equipment to be used for soils will be dependent on the condition of the soil and the amount of material required for analysis. A major differentiating factor in the selection of techniques and equipment is whether surface or subsurface sample will be obtained. Surface samples are generally easy to obtain using hand equipment, as described in Procedure 5614002. Subsurface samples are obtained by advancing borings as described in Procedure 5614004. When a more detailed description of the shallow soil conditions are desired, excavation of test pits may be required, as described in Procedure 5614003.

2.0 SOIL SAMPLE TYPES

Because it is generally difficult to interpret data obtained from composite soil samples, all samples obtained are discrete grab samples which are representative of the material under consideration. Composite samples are only obtained when it has been demonstrated in a formal sampling plan that the data generated will provide useful information on site conditions.

Grab samples are composed of material sufficient to fill two 1 pint containers, approximately 600 to 800 grams of material. Each container is filled to 75 to 90 percent by volume. Samples obtained from boreholes are placed into 1 quart wide-mouth jars.

Subsamples may be required when separate analytical tests will be performed on the same sample obtained, or duplicates will be sent to various labs. Subsampling is accomplished by dividing the initial grab sample into separate samples.

If subsampling is required, the sample is split in the field by using clean sampling canvas cloth or other appropriate material. For saturated samples, the sample is split using techniques to ensure that each subsample is representative of the material being sampled. Upon laboratory receipt of the samples, they may be further subdivided to allow for separate analytical determination.

3.0 SOIL SAMPLING LOG

A descriptive log of visual soil characteristics must be maintained for all soil sampling operations. The log is completed by a soil scientist or geologist supervising the soil sampling operations.

The log must be completed as a supplement to the data to be recorded in site field notebooks as described in Procedure 5621004. In addition, the log shall contain a detailed description of the soil encountered at the site during the sampling events. This detailed description includes:

- o Horizonation
- o Color utilizing Munsell Color Notation
- o Texture using USDA or unified classification system*
- o Density (standard penetration) or consistency
- o Odor**
- o Relative moisture content

4.0 EQUIPMENT CLEANING

In order to minimize the chances of cross contamination of samples, all sampling equipment must be carefully cleaned after obtaining each sampling. Sample containers shall also be cleaned prior to use as described in Procedure 5622006.

Equipment cleaning is undertaken in a manner which minimizes contamination of sampling sites, boreholes or monitoring wells. All wash waters and waste products generated during cleaning operations are placed in a 55-gallon drum for final disposal.

Sampling equipment is brushed with a wire brush to remove soil particles. Samplers which have been in contact with oily samples shall be wiped with absorbent cloth and then with reagent grade methanol. Samplers which have not come in contact with oily substances shall be wiped with a dry cloth. The samplers are then washed with a warm detergent solution (Liquinox, Alconox), rinsed with tap water and distilled water, wiped dry or allowed to air dry.

Thin tube samplers, split spoons and other boring rig equipment which will enter the borehole are steam cleaned with approved water, rinsed with reagent-grade methanol, and allowed to air dry prior to use.

Samplers shall be covered with plastic bags and placed into their appropriate storage containers after use.

*Field texturing shall only be undertaken when soils are known to be non-contaminated

**Odor to be determined only when respirators are determined to be unnecessary for site work.

5.0 GENERAL SAMPLING EQUIPMENT AND TECHNIQUES

Surface soil samples may be obtained using a number of manual devices such as shovels and trowels. These instruments may also be used to obtain subsurface samples at depths of up to 6 feet or in road cuts or backhoe pits. When subsurface soil samples are required at depths of greater than 6 feet, soil boring equipment is generally required.

Sampling equipment to be used for obtaining soil samples at uncontrolled hazardous waste sites must be relatively inert so as not to contaminate samples, and must be easily cleaned. The equipment must also be uncomplicated and easily operated under any level of personal protection.

Sample containers must be made of material which is compatible with the material to be sampled, resistant to breakage and of adequate size to allow for collection of at least pint (500 ml) of material. The sample containers must have wide mouth openings to allow for placing of larger pieces of consolidated materials and for ease of operation. Wide mouth, amber glass bottles (500 ml capacity) with teflon-lined caps are preferred.

Collected samples are transferred to the containers with a minimum of handling. Glass containers with plastic outer sleeves shall be used for sampling material to be analyzed for organic content, or those

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Revision: 0
Date: 4/85
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materials which contain petroleum distillates. Caps for glass containers must be teflon lined.

Plastic containers made of high density linear polyethylene (LPE), PVC or teflon are to be used when materials will not be analyzed for organics content. Plastic containers are only used when the material to be sampled is known to be non-reactive with the sample container.

Screw caps of the same material from which the containers are fabricated are used.

SUBSURFACE SOIL SAMPLING

1.0 INTRODUCTION

The objective of subsurface sampling is to obtain soil from known depths in order to evaluate site characteristics, detect the presence of any contaminants and to evaluate the potential for pollutant migration. In the following sections, the equipment and techniques used to collect subsurface soil samples are described. General procedures which shall be followed during soil sample collection, including the cleaning of sampling equipment, are presented in Procedure 5614001.

2.0 BOREHOLE DRILLING

Subsurface soil samples from boreholes can be obtained at specified depths or continuously. Several techniques can be utilized for advancing borings including jetting, wash boring, auger boring, or rotary drilling. These techniques are briefly described in Procedure 5619012. Jetting is not appropriate where soil samples are of concern.

In some instances borehole advancement, in connection with soil sampling, is accomplished by continuous sampling.

3.0 SOIL SAMPLING

The boring techniques utilized to excavate a borehole result in considerable disturbance of soil and do not allow for accurate determination of the depth from which soil materials have been excavated. Therefore split spoon, thin wall tubes or other sampling techniques must be used in conjunction with boring operations to obtain soil samples.

Subsurface samples may be obtained at predetermined depths, at every change in lithology or continuously. Continuous sampling provides the most accurate record of subsurface conditions for interpretive purposes.

3.1 Split Spoons

Split spoons are devices used to obtain subsurface samples of up to 2.5 feet in length within hollow stem auger flights, cased borings, and mudded holes. The 1.75 to 2.5 in ID split spoon samplers are advanced into the undisturbed material beneath the bottom of the casing or borehole by use of weighted hammer and drill rod. The relationship between hammer weight, drop and blows required to advance the split spoon in 6-inch increments is an indication of density or consistency of subsurface soils. After the split spoon has been driven the prescribed depth, it is removed carefully to avoid loss of soil materials. In non-cohesive or saturated soils a nest shall be used to help retain the sample.

Following removal of the split spoon from the casing, it shall be detached from the drill rod and opened to allow for visual classification of the sample. When less than a 10-inch sample has been obtained, a second cleaned sampler shall be lowered into the hole and a second sample shall be obtained. The first sample collected, if any, shall be retained unless greater sample recovery is obtained during the subsequent sampling attempts. The entire sample (except the top several inches of possibly "disturbed" material) shall be retained.

Samples of cohesive clays or silts shall be wrapped in aluminum foil prior to storage in jars, to preserve as undisturbed a sample as possible.

Once an adequate sample is collected, the sample shall be inspected, described, placed in wide mouth jars, labeled, and stored for transportation to the laboratory.

If volatile organic analyses are to be performed, VOA vials shall be filled immediately from the split spoon before jarring. Subsamples for other specific chemical analyses shall be taken as soon as possible, as required.

3.2 Thin Wall Tubes

Thin wall tubes are hollow pipes which are pressed or driven into the soil without rotation to obtain core samples of relatively undisturbed soils.

Thin wall tube samplers are generally 1.875 in ID, 2 in OD, and 2 to 3 feet long, but may be of any size convenient for sampling. The thin wall tube has a sharp cutting edge and a positive inside clearance.

Thin wall tube samplers may be pushed or driven into soils inside hollow stem auger flights, wash bore casings or uncased boreholes. The tubes are pushed into the soil without rotation until the desired depth is attained, or to refusal. If the sample tubes cannot be advanced by pushing, it may be necessary to drive the tube into the soil, without rotation, using hammers and drill rods. The tubes are generally allowed to remain in the boring for 10 to 15 minutes to allow buildup of skin friction prior to removal. The sampler is then rotated to shear the sample from the soil below and carefully removed from the borehole.

Following removal of the tube sampler from the drilling equipment, the sampler is inspected to ensure that an adequate length of sample has been obtained. This sampling procedure shall be repeated until an adequate soil core is obtained provided that

the material being sampled is of a nature which would permit retention in the sampler.

Upon successful retrieval of a soil core it shall be described and recorded in the log book and any disturbed soil shall be removed from each end of the tube. Samples for volatile organic analysis must be extracted from the solids sample as soon after the sampler is withdrawn as possible. During transport to the sampling station, the tube should be capped with a non-reactive material. For other parameter, the shelby tube shall be sealed by pouring three 1/4 inch layers of liquid wax such as Socomy Vacuum Product 2300 in each end allowing the wax to solidify between each layer. The remaining space shall be filled to the end of the cylinder with Ottawa sand or other similar sand and allowed to settle and compact. Plastic caps shall be taped over the ends of the cylinder and then sealed by successively dipping the ends into liquid wax. The tube shall then be labeled. Care should be taken in handling to label the top and bottom of the tube.

SAMPLING OF CONTAMINATED SOILS

1.0 INTRODUCTION

Soil saturated by direct leaks or discharges may contain high concentrations of contaminants, depending upon the amount of weathering to which the soil has been exposed and the physical/chemical characteristics of the contaminants.

2.0 GUIDELINES

2.1 If the soil appears to be stained from one source such as an obviously leaking tank or drum, the sample may be obtained by using a stainless steel scoop.

2.2 If the soil is stained over a large area, it may be necessary to employ a grid sampling system. It may also be advisable to obtain surface and subsurface samples. Caution is urged if subsurface samples are to be obtained due to the possibility of buried hazardous materials.

3.0 SAMPLING METHODS

(TO BE ADDED.)

4.0 REFERENCE

U.S. EPA. 1981. Technical methods for investigation sites containing hazardous substances. Technical Monograph No. 19 (Draft).

METHODS FOR COLLECTING HAZARDOUS SAMPLES

1.0 INTRODUCTION

Collecting samples of concentrated materials is an important aspect of a field investigation. These samples are analyzed to determine the presence and magnitude of the threat to the environment.

In order to assess the hazard potential of a site, it is necessary to obtain samples which may contain up to 100 percent concentration of contaminants. Depending upon the type of container the material is in and/or location of the sample, the risk of personnel exposure to contaminants is greater than at any other time during the field investigation. It is therefore important to take steps to properly protect sampling personnel (Site Health and Safety Plan) and to use sampling equipment and methods which minimize the risk of exposure.

The major criteria to consider in selecting a method and/or piece of equipment for use in obtaining hazardous samples are presented in this procedure. It should be recognized that no one method or piece of equipment will meet all the criteria listed below; however, these criteria should be considered in evaluating methods or equipment.

- 1.1 Personnel dressed in any level protection should be able to use the method/equipment selected without compromising their safety.
- 1.2 The method/equipment selected must avoid the possibility of causing synergistic reactions.

- 1.3 The method/equipment selected must avoid the possibility of sample cross-contamination.
- 1.4 The equipment selected should be easily decontaminated or preferably disposable.
- 1.5 The method/equipment selected should be time- and cost-effective.

2.0 APPROACH TO SAMPLING

2.1 Hazardous Substance Sample Containers

The quantity of sample required for a hazardous substance is typically less than the quantity required for environmental samples. The Environmental Protection Agency's (EPA) National Enforcement Investigations Center (NEIC) recommends a sample container of a capacity of 8 ounces (240 ml) or less for most concentrated samples. Certain U.S. Department of Transportation (DOT) shipping regulations also affect the type of container selected. The recommended sample container for unanalyzed solid and liquid concentrated samples is an 8-ounce wide-mouth glass jar with a Teflon-lined non-metallic screw cap. The use of a wide-mouth jar renders the task of placing the sample into the bottle easier for personnel wearing protective equipment. Protective equipment can reduce manual dexterity and visual acuity. A glass bottle with a Teflon-lined screw cap is the recommended sample container for unanalyzed samples obtained from closed containers where reliable information does not exclude the possible presence of a substance designated as "Poison A" by DOT. The bottle must be small enough to fit through the valve assembly hole of a steel compressed gas cylinder. The sample containers should be laboratory cleaned and obtained from the EPA sample bottle depository.

2.2 Hazardous Substance Sampling Equipment

A list of suggested equipment for obtaining samples of hazardous substances is presented below. Other equipment can be used, but it should be disposable or easily decontaminated.

- o 4-foot lengths of glass tubing with bore size ranging from 6 mm to 20 mm. (Lengths of polyethylene tubing should be available if caustics or hydrofluoric acid are encountered)
- o Assorted rubber stoppers to fit above tubing
- o Hand-operated, intrinsically safe vacuum pump
- o Chemically resistant tubing 5/16" inside diameter; Teflon recommended
- o Wax pencils
- o Masking tape
- o Indelible ink pen
- o 250 ml Erlenmeyer filtering flask with #6 one-hole stopper
- o 500 ml Erlenmeyer flask with solid stopper
- o 3-way Teflon valve
- o 2-hole stopper fixed with short lengths of glass tubing (1 90° elbow) to fit neck of sample bottle. Used as low cost substitute for filtering flask and eliminates need for transferring hazardous material to the sample container
- o Assorted lengths and diameters of wooden doweling or corner molding
- o Plastic sandwich bags (self-sealing bags not recommended in this case) and elastic bands
- o Disposable wooden "toaster" or "photographer" tongs
- o Disposable scoops, polyethylene, or stainless for solid materials
- o Litmus paper or pH range paper to use in waste characterization
- o Brass deflagrating spoon

- o Hand auger
- o Shovel
- o Stainless steel bailers with steel wire or monofilament line
- o Sample tags
- o Field log book
- o Chain-of-Custody forms
- o Camera/film
- o Plastic containers/decontamination solutions for decontaminating outside of sample containers
- o Sample packaging and shipping equipment (see Monograph 22)

2.3 Hazardous Substance Sample Locations

The locations of hazardous substance samples will be determined by the disposal practices at a given site. Typically, they would include all of, but not necessarily be limited to, the following:

1. Open or closed containers including drums, abandoned tank trucks, railroad tank cars, buried or above-ground storage tanks.
2. Surface impoundments such as ponds, pits or lagoons which have received direct bulk discharges of concentrated wastes.
3. Piles of concentrated sludges or contaminated soil.
4. Soil near leaking drums, tanks or direct discharges.
5. Leachate breakouts.
6. Monitoring wells known to be located immediately adjacent to buried wastes.

Additionally, if the presence of a highly toxic substance has been confirmed on site, samples which would routinely be treated as environmental samples might have to be considered hazardous.

The approach to sampling Items 2 through 6 above involves modifying the appropriate environmental sampling technique to safely obtain a potentially concentrated sample. The sampling of containers (Item 1), especially drums, is one of the more frequently requested tasks at uncontrolled hazardous substance sites. Therefore, Procedure 5623002 and 5623003 provide more details of such sampling.

2.4 On-Site Containers

Containers at a hazardous site, typically steel drums, may have to be sampled to provide analytical data for initial site characterization and the preparation of legal cases. As the work at a particular site progresses, further sampling may be required as part of a site cleanup effort. The containers chosen for sampling may be opened or closed. A sampling plan should first be developed which takes the objective of the sampling operation under consideration. Cleanup activities may require that all containers be sampled and analyzed prior to ultimate treatment or disposal, whereas legal case preparation will require the sampling of fewer containers.

The selection of containers to be sampled is based on a variety of factors including accessibility, background information and container conditions. The following is an outline of an approach to prepare for sampling from containers. For purposes of example, the outline is specific for drums. Methodologies for actually obtaining samples from other types of containers are addressed in Procedure 5623003.

Container Inventory

If possible, an initial inventory of containers should be made from off site using observation, aerial photography, or remote sensing techniques. The purpose is to determine the effort needed to conduct the sampling as well as the hazards that may be expected on site.

An on-site inventory is then made to determine the number and condition of the drums, to further establish the conditions of the site and to record drum markings or any other information that might assist the investigation team. Each drum selected for sampling will be given a sampling number that will be marked on the container by spray painting, tagging or other means. A complete photo record of the drum's condition will be obtained.

Sample Selection Criteria

As previously mentioned, a site cleanup operation usually requires opening and sampling each drum. For evidentiary purposes, however, it is usually necessary to open and obtain samples from relatively few drums. The number selected will be determined by factors such as total number of drums on the site, analytical constraints, background information, community sensitivity, etc.

The initial step before sampling is to exhaust all sources of background information on the drum contents. If reliable information exists, the selection of one or more drums for sampling may be based on this information and confirmed by subsequent sample analysis.

In the absence of reliable information about drum contents, a random sampling approach may be employed. The first step is to identify the total number of drums readily accessible for opening and sampling. This would include those drums which present no problem to setting up the selected remote opening device, which do not have to be moved prior to opening, and whose physical location poses no threat to the safety of the team.

For example, on a site containing 10,000 randomly placed drums, many will be physically inaccessible, (i.e., in the center of a large group or stacked on other drums). A simple random sampling scheme can be used to determine which of the accessible drums to sample. Each drum can be assigned a consecutive number, and a random number table can be used to choose those drums to be opened and sampled.

For example, assume the total available number of drums for opening and sampling is 100 and five samples are desired. Number the drums consecutively from 00 to 99. Choose any number on the table as a starting point and move in any predetermined direction in the table and select a number at any predetermined interval until five numbers have been selected.

Hazardous Substance Sampling Techniques

The majority of hazardous substance samples are grab samples. Occasionally, it is necessary to sample a multiphase liquid medium, which will require either sampling each phase or obtaining a representative multi-phase sample, depending upon the objective of the sampling.

In general, the avoidance of contact with the contaminant is of utmost importance. Even though protective clothing and equipment

are used by sampling personnel, it is prudent to use only those sampling techniques which minimize the risk of exposure. Sampling personnel should not kneel, sit, run (except to evacuate in an emergency), lean upon containers, walk through puddles, etc.

Some general preparations should be made for obtaining samples of hazardous substances, including the following:

- 2.4.1 A sampling plan should be developed prior to sampling (project operations plan or equivalent).
- 2.4.2 Sample containers should be prepared by temporarily marking the designated sample number on the container using a wax pencil or some sort of label. Pre-attached sample tags are not recommended because they interfere with the sampling operation and may become contaminated. The sample tags can be affixed following container decontamination.
- 2.4.3 Following temporary marking, a small plastic bag is placed around the container and secured at the bottle neck with a rubber band. This minimizes the contact of contaminants with the outside of the container. Following the sampling operation and return of the container to the decontamination station, the bag is removed and discarded.
- 2.4.4 If a large number of samples are to be taken, a decontamination system should be set up for cleaning the outside of the containers following removal of the plastic bag. The same decontamination solutions as for personnel may be used, and small plastic dishpans may be used to hold the solutions. Smaller numbers of samples could conceivably be brought through the personnel decontamination station.

conceivably be brought through the personnel decontamination station.

2.4.5 Following decontamination, the sample containers are tagged and logged on the Chain-of-Custody record.

2.4.6 Preparation should be made for the transport of containers and equipment. If Level B personal protection is being used, no more than a few samples can be obtained between respirator air tank changes. In addition, a combustible gas detector and an oxygen meter may be required. A wheelbarrow or cardboard box can be used to transport equipment. Cardboard mailing tubes taped at one end can be used to hold glass tubing. In all cases, care should be taken to avoid allowing spilled material from the outside of sample containers to mix in the the transport container.

2.4.7 If manpower permits, a third member of the sampling party could be employed to transfer samples and containers to and from the hot line.

3.0 REFERENCE

U.S. EPA. 1981. Technical Methods for Investigating Sites Containing Hazardous Substances. Technical Monograph No. 19. (Draft)

SOIL TEST PIT SAMPLING

1.0 GENERAL

Test pits excavations are usually constructed using backhoes from which soil samples can be obtained. Test pits expose shallow soil units in order to obtain detailed soil descriptions and multiple samples from specific soil horizons.

2.0 EQUIPMENT

Back hoes equipped with front end loader attachments are generally used for excavation. The front end bucket facilitates backfilling of the test pit following completion of work.

3.0 PROCEDURE

Test pits shall be excavated by incrementally removing soil material and placing it away from the edge of the test pit. Test pits usually should not be excavated to depths greater than 5 feet unless the walls are properly braced as described in OSHA regulations. Test pits exhibiting evidence of headwall cracking or slumping should not be entered until properly stabilized.

Test pits which will remain open for longer than one day shall be fenced, using a snow fence, to minimize the risk of inadvertent entry of unauthorized personnel or animals. The fence shall be erected at a distance no less than 6 feet from the perimeter of the test pit. Test pits shall be backfilled as soon as possible following completion of sampling and soil profile description.

Soil sampling within test pits is accomplished following Procedure 5614001—General Soil Sampling Procedures, and using any of the devices described in Procedure 5614002, Surface and Shallow Depth Sampling, including trowels, shovels, trier, core samplers or augers. Core samplers can be used to obtain both vertical and horizontal soil samples for use in hydraulic conductivity determinations from test pits.

APPENDIX C

FIELD VAPOR DETECTOR OPERATION PROCEDURES

OPERATION PROCEDURE FOR
HNU MODEL PI 101
PHOTOIONIZATION ANALYZER

1. INTRODUCTION

1.0 Operation Principle

The HNU Model 101 photoionization detector has been designed to measure the concentration of trace gases in many industrial or plant atmospheres. The instrument has similar capabilities outdoors. The analyzer employs the principle of photoionization for detection. This process is termed photoionization because the absorption of ultraviolet light (a photon) by a molecule leads to ionization via:



where RH = trace gas

$h\nu$ = a photon with an energy greater than or equal to an ionization potential of RH.

The sensor consists of a sealed ultraviolet light source that emits photons which are energetic enough to ionize many trace species (particularly organics), but do not ionize the major components of air such as O_2 , N_2 , CO , CO_2 or H_2O . A chamber adjacent to the ultraviolet light source contains a pair of electrodes. When a positive potential is applied to one electrode, the field created drives any ions, formed by absorption of UV light, to the collector electrode where the current (proportional to concentration) is measured. The useful range of the instrument is from a fraction of a ppm to about 2,000 ppm.

2.0 Instrument Sensitivity and Calibration

The instrument responds to atmospheric compounds with ionization potentials equal to or less than the ionization energy of the UV light source. If a compound in air has an ionization potential greater than the energy source of the lamp, it will not be detected. Table 1 presents organic and inorganic compounds and the light sources that should be used to detect each compound. The instrument is capable of using 1 of the 3 light sources - 9.5, 10.2, and 11.7 ev lamps. In addition, not all compounds respond equally to each light sources and thus they vary in their sensitivity to ionization. As a result of varying sensitivities to photoionization, the response given by the instrument may or may not reflect the actual atmospheric concentration of the compound being detected. Table 2 represents the relative sensitivities for various gases relative to a 10.2 ev light source. Use this table to determine the approximate response of the instrument to a compound of interest, and to select the appropriate light (lamp) source.

TABLE 1 (CONTINUED)

10.2 eV Lamp Source (Cont'd.)

Iodine vapor	Phosphine
Isopropanol	Phosphorus trichloride
Ketones	Picolines
Lutidines	Pinene
Methyl bromide	Propylene
Methyl isocyanate	Pyridine
Methyl mercaptan	Pyrole
Methyl methacrylate	Styrene
Mineral spirits	Tetrahydrofuran
Naptha	Tetraethyl lead
Nitrates	Thionyl chloride
Nitrites	Toluene
Nitro alkanes	Vinyl acetate
Nitro benzene	Vinyl bromide
N-Octane	Vinyl chloride
Olefins	Vinylidene chloride
Phenol	
Phos toxin	

11.7 Lamp Source

Acetic anhydride	Formic acid
Acetylene	Methanol
Acrylonitrile	Methylene chloride
Alcohols	Nitrates
Aldehydes	Nitrites
Aliphatics	Nitro alkanes
Alkyl halides	Phos toxin
Butane	Propane
Carbon tetrachloride	Serafume
Chloroform	
Ethane	
Ethylene dichloride	
Formaldehyde	

TABLE 2 RELATIVE SENSITIVITIES FOR VARIOUS GASES
(10.2 eV Lamp) (Continued)

Species	Photoionization Sensitivity*
b-pinene	0.5
citral	0.5
ammonia	0.3
acetic acid	0.1
nitrogen dioxide	0.02
methane	0.0
acetylene	0.0

*Expressed in ppm (v/v).

II. OPERATIONAL PROCEDURE

1.0 Instrument Check-Out

- 1.1 Remove instrument box cover by pulling up on fasteners.
- 1.2 On the instrument panel, there will be a label containing information on light source, calibration date, calibration gas, and span setting.
 - 1.2.1 If the instrument has not been calibrated in the last 14 days or since its last field use, it should be recalibrated. Check the instrument log, which should be maintained with the instrument, for the instrument status and its calibration history. For general use, the instrument should be calibrated to isobutylene at a span setting of 9.8.
 - 1.2.2 Check the label for light source and refer to Table 1 for ionization potentials of various compounds. If the compound you wish to detect is not listed for the light sources provided with instrument, then the light source will have to be changed. Use the probe with the proper light source for the compounds to be detected.
 - 1.2.3 Once it has been determined that the instrument has the correct lamp, the instrument may need to be recalibrated for the specific compound of interest. Use Procedure under 2.1.3 of this Section to calibrate the instrument.
 - 1.2.4 Check the battery supply by connecting the probe to the instrument box, and turning the function switch to the battery check position (Figure 1). (Note: The battery check indicator will not function unless the probe is attached.) The meter needle should deflect to the far right or above the green zone. If the needle is below or just within the green zone or the red LED indicator is on, the battery should be recharged. Follow the procedure described in Section III (Maintenance and Trouble shooting) to recharge the battery.
 - 1.2.5 Repack the instrument for shipment to the field.

2.0 Field Operation

2.1 Calibration

2.1.1 Equipment and Materials

0 Calibration Gas (2 ranges)

Low range 0-20 ppm and mid-range 20-200 ppm of isobutylene gas are used for standard field operation when contaminants are unknown or a mixture of gases is present. The isobutylene gas is used for general calibration because of the instrument's relatively high sensitivity to it and the non-toxic nature of the gas.

Note: A specialty gas may be required if a single atmospheric contaminant is present and the contaminant has a sensitivity different from that of the calibration gas (isobutylene).

0 Tubing and fittings (see Figure 2).

0 Rotometer or bubble flow meter.

0 Field Log, calibration form, and data reporting form.

0 Table 1 for ionization potentials for compounds of interest.

2.1.2 Calibration Frequency

This instrument should be calibrated after each field use and prior to each field use. Continuous calibration check should be performed frequently during field operation (for example, check the instrument zero and calibration after every 10 measurements) and document the results properly. Caution: Do Not Change the Settings.

2.1.3 Calibration Procedure

2.1.3.1 Use a three-points procedure to facilitate the proper instrument calibration over appropriate operating ranges. Distinct mixtures of calibration gas with known concentration for selective operating range should be used for calibration. Each mixture should give a 3/4 scale deflection in its respective operating range.

2.1.3.2 Instrument Setup.

Step 1: Remove Instrument cover by pulling up on the side straps.

- Step 2: Prior to calibration, check the function switch (Figure 1) on the control panel to make sure it is in the OFF position. The probe nozzle is stored inside the instrument cover. Remove cover plate by pulling up on the pins that fasten the cover plate.
- Step 3: Remove the nozzle from the cover. Assemble probe by screwing nozzle into casing.
- Step 4: Attach probe cable to instrument box inserting 12 pin interface connector of the probe cable into the connector on the instrument panel. Match the alignment keys and insert connector. Turn connector in clockwise direction until a distinct snap and lock is felt.
- Step 5: Turn the function switch to the Battery Check position. When the battery is charged, the needle should read within or above the green battery arc on the scale plate. If the needle is below the green arc or the red LED light comes on, the instrument should be recharged prior to making any measurements. Implement steps in Section III to recharge battery.
- Step 6: Turn the function switch to the ON position. In this position, the UV light source should be on. To verify, gaze at the end of the probe for a purple glow. Do Not Look Directly at the Lamp Itself. If the lamp does not come on refer to Maintenance Step in 2.2 (Section III).
- Step 7: To zero the instrument, turn the function switch to the standby position and rotate the zero potentiometer until the meter reads zero. Clockwise rotation of the zero potentiometer produces an upscale deflection while counter clockwise rotation yields a downscale deflection. (Note: No zero gas. is needed since this is an electronic zero adjustment.) If the span adjustment is changed during instrument calibration, the zero should be rechecked and adjusted. If necessary, wait 15 to 20 seconds to ensure that the zero reading is stable. Readjust as necessary.

Step 2: Before entering a contaminated area, determine background concentration. This concentration should be used as a reference to readings made in the contaminated area. Under no circumstance should one attempt to adjust the zero or span adjustments while the instrument is being operated in the field.

Step 3: Take measurements in contaminated area, recording readings and locations. Should readings exceed the 0-20 scale, switch the function switch to the 0-200 or 0-2,000 range as appropriate to receive a direct reading. Return the instrument switch to the 0-20 range when readings are reduced to that level. Record measurements in notebook or on an appropriate form.

Step 4: Keep in mind health and safety action guidelines for the level of protection you are wearing. Sustained readings above a certain level may force you to vacate an area or upgrade your level of protection.

Note: The instrument will not function properly in high humidity or when the window to the light housing is dirty. If the instrument response is erratic or lower than expected.

Step 5: When finished, use the reverse Steps 1 thru 5 of Section 2.1.3.2 (Instrument Setup) to shut down the instrument.

III. MAINTENANCE AND TROUBLE-SHOOTING

1.0 Battery Recharging

1.1 The instrument should be recharged 1 hour for each hour of use or overnight for a full day's use. (The battery will last 10 hours on a full charge.)

1.2 To recharge the battery (or instrument):

1.2.1 Turn the function switch to the off position.

1.2.2 Remove the charger from the instrument top compartment.

1.2.3 Place the charger plug into the jack on the left side of the instrument box.

1.2.4 Connect the charger unit to a 120 V AC supply.

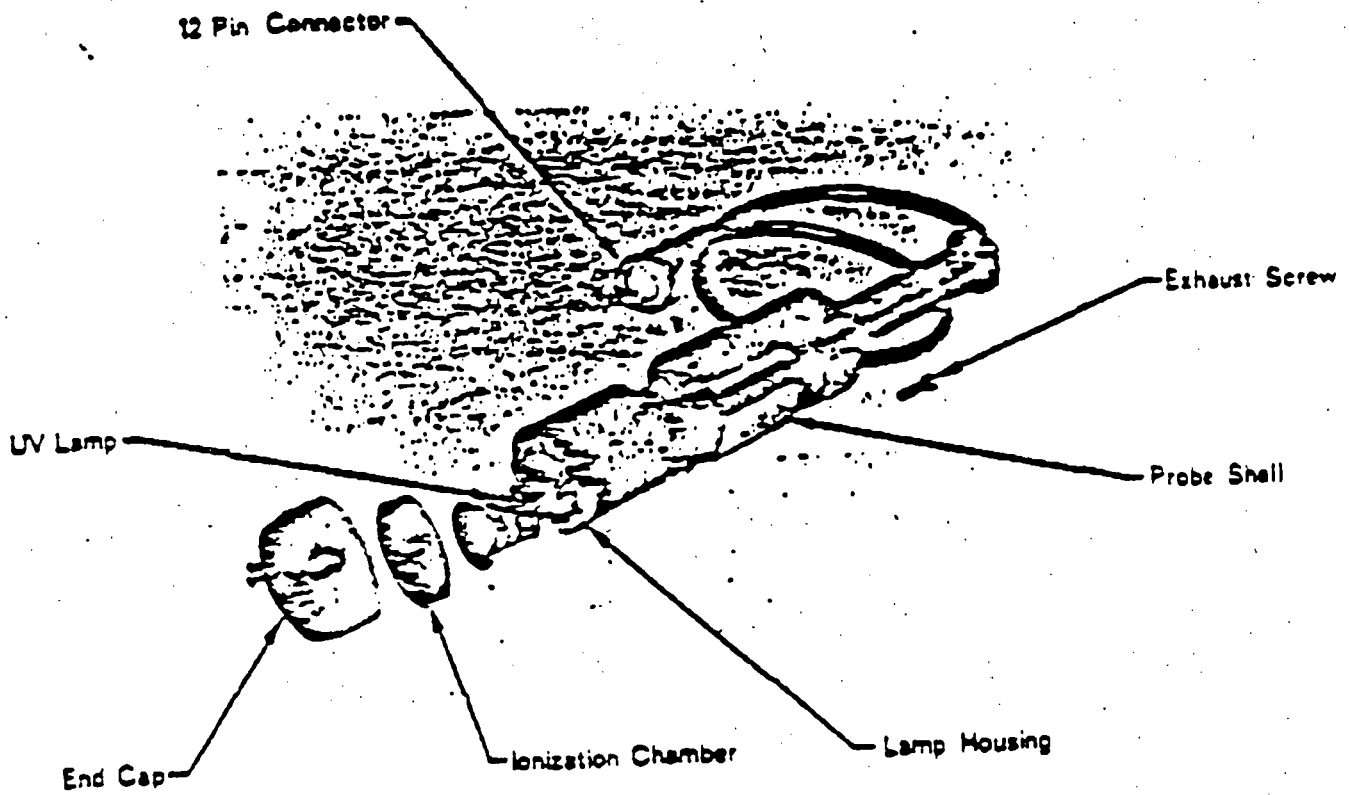


FIGURE 3 COMPONENT PARTS OF PROBE

4. Check 2 amp fuse.

5. If none of the above solves the problem, consult the factory.

3.2 Meter responds in BATT CHK position, but reads zero or near zero for all others.

1. Power supply defective: Check power supply voltages per Figure 4. If any voltage is out of specification, consult the factory.

2. Input transistor or amplifier has failed: Rotate zero control; meter should deflect up/down as control is turned. Open probe; both transistors should be fully seated in sockets.

3. Input signal connection broken in probe or readout: Check input connector on printed circuit board. Should be firmly pressed down. Check components on back side of printed circuit board. All connections should be solid, and no wires should touch any other object. Check all wires in readout for solid connections.

3.3 Instrument responds correctly in BATT CHK, and STBY, but not in measuring mode.

1. Check to see the light source is on (See Section 2.2).

2. Check high voltage power supply (See Figure 4).

3. Open end of probe, remove lamp and check high voltage on lamp contact ring.

4. If high voltage is present at all above points, light source has most likely failed. Consult the factory.

3.4 Instrument responds correctly in all positions, but signal is lower than expected.

1. Check span setting for correct value.

2. Clean window of light source (See 2.3).

3. Double check preparation of standards.

4. Check power supply 180 V output. See Figure 4.

5. Check for proper fan operation. Check fan voltage. See Figure 4.

6. Rotate span setting. Response should change if span pot is working properly.
- 3.5 Instrument responds in all switch positions, but is noisy (erratic meter movement).
 1. Open circuit in feedback circuit. Consult the factory.
 2. Open circuit in cable shield or probe shield. Consult the factory.
 - 3.6 Instrument response is slow and/or irreproducible.
 1. Fan operating improperly. Check fan voltage. See Figure 4.
 2. Check calibration and operation.
 - 3.7 Low battery indicator.
 1. Indicator comes on if battery charge is low.
 2. Indicator also comes on if ionization voltage is too high.

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OPERATING PROCEDURE CENTURY PORTABLE ORGANIC VAPOR ANALYZER (OVA), MODEL 128

1.0 INTRODUCTION

1.1 Operating Features

The Century portable organic vapor analyzer (OVA) is designed to detect and measure gases and organic vapors in the atmosphere. The instrument utilizes the principle of hydrogen flame ionization for detection. The instrument measures gases and vapors by producing a response to an unknown sample, which can be related to a gas of known composition to which the instrument has been previously calibrated. During normal survey mode operation, a continuous sample is drawn into the probe and transmitted to the detector chamber by an internal pumping system. The sample flow rate is metered and passed through particle filters before reaching the detector chamber. Inside the detector chamber the sample is exposed to a hydrogen flame. When most organic vapors burn, they leave behind positively charged carbon containing ions which are collected by a negative collecting electrode in the chamber. An electric field exists between the conductors, surrounding the conductors, surrounding the flame and the collecting electrode. As the positive ions are collected, a current corresponding to the collection rate is generated on the input electrode. The current is measured with a linear electrometer preamplifier which has an output signal proportional to the ionization current. A signal conditioning amplifier is used to amplify the signal from the preamp and to condition it for subsequent meter or external recorder display. The meter display is an integral part of the Probe/Readout Assembly and has a scale from 0 to 10.

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The instrument consists of two major assemblies: the Probe/Readout Assembly and the Side Pack Assembly. The output meter and alarm level adjustments are incorporated into the hand held Probe/Readout Assembly. The Side Pack Assembly contains the remaining operating controls and indicators.

1.2 Controls/Indicators

1. INSTR/BATT Test Switch - A three position toggle switch that in one position turns instrument on, except pump and alarm, in second position turns all power off, and third position displays battery charge condition on the readout meter.
2. PUMP (ON-OFF) Switch - This toggle switch turns on power to the internal pump and audio alarms.
3. Ignitor Switch - This momentary push button switch connects power to the ignitor coil in the detector chamber and simultaneously disconnects power to the pump.
4. CALIBRATE Switch - This three position toggle switch selects the desired range: X1 (0-10 ppm); X10 (0-100 ppm); X100 (0-1,000 ppm).
5. CALIBRATE ADJUST (Zero) knob - This potentiometer is used to "zero" the instrument.
6. GAS SELECT Knob (span control) - This ten-turn dial readout potentiometer sets the gain of the instrument commonly referred as span control.
7. Recharger Connector - This BNC connector is used to connect the battery pack to the battery recharger assembly.
8. H₂ TANK VALVE - This valve is used to supply or close off the fuel supply from the hydrogen tank.
9. H₂ TANK PRESSURE Indicator - This high pressure gauge measures the pressure in the hydrogen fuel tank which is an indication of fuel supply.
10. H₂ SUPPLY VALVE - This valve is used to supply or close off the hydrogen fuel to the detector chamber.

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11. H_2 SUPPLY PRESSURE Indicator - This low pressure gauge is used to monitor the hydrogen pressure at the capillary restrictor.
12. SAMPLE FLOW RATE Indicator - This indicator is used to monitor the sample flow rate.
13. Refill Connection - This 1/4 inch AN fitting is used to connect the hydrogen refill hose to the instrument.
14. REFILL VALVE - This valve is used to open one end of the instrument fuel tank for refilling with hydrogen.
15. Earphone Jack - This jack is used to connect the earphone; it turns off the speaker when in use.
16. VOLUME Knob - This potentiometer adjusts the volume of the internal speaker and earphone.
17. Readout and Sample Connectors - These connectors are used to connect the sample hose and umbilical cord from the Probe/Readout Assembly to the Side Pack Assembly.

2.0 Specifications

Sensitivity: 0.1 ppm (methane)

Response time: Less than 2 seconds

Readout: three ranges: 0 to 10 ppm, 0 to 100 ppm, 0 to 1,000 ppm, 250' linear scaled meter

Sample flow rate: Nominally 2 units

Fuel Supply: 75 cubic centimeter tank of pure hydrogen at maximum pressure of 2,300 PSIG, fillable while in case

Primary Electrical Power: Rechargeable and replaceable battery pack at 12 V DC

Service Life: Hydrogen supply and battery power - 8 hours minimum

Detection Alarm: Frequency modulated audible alarm. Can be preset to desired level. Frequency varies as a function of detection level.

Flame-out Indication: Audible alarm plus visual meter indication

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Battery Test: Battery charge condition indicated on the readout meter or battery recharger

Probe: Telescoping adjustment over 8 inches or probe can be completely removed from readout assembly.

Filtering: In line particle filters and activated charcoal filter

3.0 OPERATION PROCEDURE

Note: A condensed operating procedure checklist is provided inside the cover of the side pack.

3.1 Instrument Setup

3.1.1 Initial Assembly

Select Survey method (normal or "close area").

1. Normal Survey Configuration:

- a. Connect the adjustable length probe to the Readout Assembly with the captive locking nut. Ensure that the probe is seated firmly in the Readout Assembly.
- b. Select the desired pickup fixture and check that a particle filter is installed.
- c. Connect the pickup fixture to the probe using the knurled locking nut.
- d. Connect the umbilical cord and sample hose to the Side Pack Assembly.

2. "Close Area" Survey Configuration:

- a. Check to ensure that a particle filter is installed in the close area sampler.
- b. Connect the close area sampler directly to the Readout Assembly.
- c. Connect the umbilical cord and sample hose to the Side Pack Assembly.

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3.1.2 Fuel Supply

Check hydrogen supply by opening the H₂ Tank Valve and noting pressure. At least 1,600 pounds of pressure is required for 8 hours of usage. Refill tank if it contains less than 1,600 pounds and 8 hours of usage is required. The hydrogen supply tank is refilled following steps under 4.0 of this procedure.

3.1.3 Battery Check

Move INSTR/BATT test switch to the BATT position and note meter deflection on Readout Assembly. If the needle is below the battery mark on the readout, the battery will have to be recharged. Recharge battery following steps under 4.0 of this procedure.

3.1.4 Calibration

The instrument is normally calibrated to methane gas. When calibrated to methane gas, the GAS SELECT (span) Control is set to 300. Check the calibration label on instrument to determine date of calibration and calibration gas used. If the instrument requires recalibration, implement Procedure 6607003 before combining with this procedure.

3.2 Instrument Startup

The GAS SELECT control should be preset to the desired dial indication prior to turning instrument. This control is set during instrument calibration (Procedure 6607003) and must not be adjusted during instrument operation.

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1. Move Instrument (INSTR) Switch to ON and allow 5 minutes for warm up.
2. To set the audible alarm to a predetermined level (the level should be based on health and safety guideline, refer to the site health and safety plan for the action level):
 - a. Turn pump switch ON.
 - b. Adjust meter pointer to the desired alarm level using the CALIBRATE ADJUST (zero) knob.
 - c. Turn the Alarm Level Adjust knob on the back of the Readout Assembly until the audible alarm just comes on.
 - d. Adjust speaker volume with Volume Knob. If earphones are desired, adjust volume using earphones.
 - e. The instrument is now preset to activate the alarm when the level exceeds that of the setting.
3. Move the CALIBRATE Switch to X10 and adjust the meter reading to zero with the CALIBRATE ADJUST (zero) knob.
4. Check to see that the PUMP Switch is ON and observe the SAMPLE FLOW RATE Indicator. Indication should be approximately two units.
5. Open H₂ TANK VALVE one turn and observe reading.
6. Open H₂ SUPPLY VALVE one turn and observe reading. CAUTION: Do not leave H₂ SUPPLY VALVE open when the pump is not running. This will allow hydrogen to accumulate in the detection chamber.
7. Confirm that meter is still reading zero (readjust if necessary).
8. Depress ignitor button. Instrument pumps will go off. There will be a slight pop as hydrogen ignites. The meter pointer will go upscale of zero. Immediately after hearing the "pop", release ignitor button. Do not depress ingitor button for more than 6 seconds. If the hydrogen fails to ignite after 6 seconds, allow instrument to run for 2 minutes before attempting to ignite hydrogen again. If the hydrogen fails to ignite following repeated attempts at ignition, repeat entire instrument start up steps or refer to Procedure 6607003 for maintenance of the instrument.

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9. After ignition, the meter needle will indicate the background hydrocarbon level at area where instrument has been started. Note the background level in notebook or field log book.
10. Place CALIBRATE Switch in 1X range and move instrument to an area which is representative of the lowest ambient hydrocarbon concentration. Adjust the meter to 1 ppm with the CALIBRATE ADJUST (zero) knob. (Record all background readings.)

Note: The instrument has a low level (<0 ppm) alarm which indicates flame out. Placing or zeroing meter at 1 ppm will prevent normal background fluctuations from activating the low level alarm. This 1 ppm "zero" value must be subtracted from all measurements.
11. The instrument is now ready for field use.

3.3 Operating Procedures

1. Set the CALIBRATE switch to the 1X level. If, during taking measurements, the meter goes off scale, adjust CALIBRATE switch to 10X or 100X to record levels.
2. Take measurements at ground, waist, and head levels at all areas of the site to be surveyed. Drum openings, enclosures, etc. should be surveyed for organic vapors. Record all measurements in field log book or notebook. Record measurements relative to calibration standard, not as ppm in air.
3. When organic vapors are detected, the meter pointer will move upscale and the audible alarm will be activated if the level exceeds the preset value. The frequency of the alarm will increase as the level of exceedence is increased.
4. If the flame out alarm is actuated, ensure that the pump is running and depress the ignitor button. This should reignite the hydrogen. Flame out can be caused by explosive or oxygen deficient atmosphere. It can also be caused by constriction or blockage of the inlet tube.

3.4 Shut Down Procedure

1. Close H₂ SUPPLY VALVE.
2. Close H₂ TANK VALVE.

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3. Move INSTR Switch to OFF.
4. Wait 5 seconds and move PUMP Switch to OFF. The instrument is now in shut down configuration.

4.0 FUEL REFILLING

The instrument should be completely shut down for hydrogen tank refilling. The refilling should be done in a ventilated area. There should be no potential ignitors or flame in the area.

1. Attach filling hose to external source of hydrogen. Pure hydrogen of 1,600 to 2,300 psi will be required.
2. Crack open valve on hydrogen supply, place FILL/BLEED valve on hose in FILL position and purge hose for 2-3 seconds.
3. Close FILL/BLEED Valve (OFF position) and immediately attach other end of fill hose to instrument fill connection and tighten the connection.
4. Open supply valve external on hydrogen tank 1/2 to 1 turn. Set regulator to 1,600 to 2,300 psi.
5. Open the REFILL Valve and the H₂ TANK VALVE on the instrument.
6. Place FILL/BLEED Valve in FILL position. The instrument hydrogen tank should now be filling.
7. The instrument H₂ Pressure Indicator should now indicate instrument tank pressure. This pressure should approximate that of the external supply tank regulator gauge.
8. After the instrument tank is filled, shut off:
 - a. The REFILL VALVE on the instrument panel.
 - b. The FILL/BLEED Valve on the filling hose assembly.
 - c. The valve on the external hydrogen supply bottle.
9. The supply hose and internal lines on the instrument now contain hydrogen under pressure. To reduce this pressure to atmospheric pressure:
 - a. Turn FILL/BLEED Valve to BLEED position until gas can no longer be heard escaping.

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- b. Turn FILL/BLEED Valve to FILL position to allow gas trapped in the connective fittings to go into the hose assembly.
 - c. Turn FILL/BLEED Valve to BLEED position to bleed off this pressure.
 - d. Turn FILL/BLEED Valve to OFF position. Keep valve in OFF position.
- 10. Close H₂ Tank Valve.
 - 11. Remove fill hose from instrument. Any gas still under pressure will escape as the connector is removed. Release of gas should only be momentary.
 - 12. As a check of the integrity of the instrument's hydrogen supply system, observe the H₂ TANK PRESSURE Indicator with the system shut down. Release of internal pressure should not go down rapidly. If there is a rapid decrease (greater than 350 PSIG/hour) with the instrument in shut down mode, there is a significant leak in the H₂ supply system. If so, the instrument should be returned to the manufacturer for repairs.

5.0 BATTERY RECHARGING

The battery should be recharged following each use of 4 hours or more, or when the battery check indicator indicates need of a charge. Never charge instrument in hazardous environment or when refilling hydrogen tank.

- 1. Remove cover from battery charge part on instrument.
- 2. Plug charger BNC connector into mating connector on battery cover and insert AC plug into 115 VAC wall outlet.
- 3. Move battery charger switch to the ON position. The light above the switch should illuminate.
- 4. Battery charge condition is indicated by the meter on the front panel of the charger; meter will deflect to the right while charging. When fully charged, the pointer will be in line with the charged mark above the scale.

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5. Approximately 1 hour of charging time is required for each hour of operation; 12 hours for complete charge. Do not charge for more than 24 hours.

6.0 REFERENCE

Foxboro Analytical. No date. Instruction and Service Manual, Century Systems Portable Organic Vapor Analyzer Model OVA-128 M1 2R900AC.

APPENDIX D

PROCEDURES FOR COLLECTION, FILTRATION, AND FIELD MEASUREMENTS OF WATER SAMPLES FROM GROUNDWATER MONITORING WELLS

SAMPLING PROCEDURES FOR MONITORING WELLS

1.0 INTRODUCTION

General procedures for sampling monitoring wells include pre-sampling procedures, well-evacuation, sample withdrawal, field testing of parameters, and sample preparation and preservation. Certain special considerations for organic samples exist and are described as well.

Sampling protocol must be adhered to strictly to insure the collection of ground water samples representative of actual subsurface conditions. Correct procedures are particularly important at hazardous materials sites, where in addition to sample integrity, other considerations such as cross-contamination, safety, and legal responsibility are of concern.

The following general procedures are followed during sampling of monitoring wells.

2.0 PRE-SAMPLING PROCEDURES

Pre-sampling procedures include records, equipment, cleaning, and water level measurement. In addition, the well should be checked for above-ground or below-ground damage.

2.1 Records

Prior to sampling, general information concerning the site, well and sampling technique should be recorded on the field record sheet or log.

Obtain and record data in as complete a manner as possible and in a manner suitable to the study. Items to consider include:

1. Site name and number.
2. Exact location of well or source of sample and well or source number.
3. Weather conditions.
4. Point and method of collection.
5. Depth and diameter of well.
6. Casing record.
7. Screened, slotted, perforated, or louvered intervals.
8. Types of screens, slots, perforations, or louvers.
9. Water-bearing formations(s).
10. Water level.
11. Rate of discharge.
12. Duration of pumping prior to sampling.
13. Water temperature.
14. Other field measurements (including pH, conductivity, DO, etc.).
15. Date.
16. Time of collection.
17. Sample number.
18. Type of sample.
19. Preservative type and amount.
20. Appearance and any other relevant data.
21. Filter size used and on which samples.
22. Use of water (if any).
23. Purpose of sampling.
24. Sampler's initials.

In addition, each sample should be labeled separately with site number, well, and sample identification, sampler's initials, time and date of collection, type of sample, and preservative type and amount. Detailed labeling procedures are described in procedure 5622002 and 5622004.

After sampling is completed, correct labeling and shipping procedures (5622001) and sample chain of custody (procedure 5622005) must be adhered to.

2.2 Equipment

All equipment should be assembled, calibrated, and tested before arriving at the site. All items which potentially come in contact with the ground water samples should be pre-cleaned according to procedure 5621003. Between sampling locations, all items which come in contact with sample water should be either disposed of or thoroughly cleaned.

All apparatus, buffers, and samples should be kept out of direct sunlight to avoid temperature fluctuations, particularly pit buffers.

Lay out all equipment on the plastic drop cloth adjacent to the sampling location, to prevent contamination of or from the outside environment. A truck tailgate provides an excellent equipment bench, if the site is accessible to vehicles.

A list of equipment necessary for sampling of monitoring wells at hazardous waste sites is given below.

2.2.1 Well Evacuation and Sample Withdrawal

- Disposable chemically inert gloves (separate pair for each sampling location).
- A sampler apparatus (e.g., Kemmerer, Bailer) with a capacity to collect 750 to 1000 ml of sample per trip, including sample transfer tubing.
- A 500 foot or more length of nylon cord or cable marked in 5, 25, and 100 foot increments on a retrieval system for use with the Kemmerer or Bailer.
- Pump and Power supply (if needed).

2.2.2 Field Measurements

- Tape measure marked in tenths and hundredths of feet.
- Calibrated M-scope or similar water level recording device.
- Dissolved oxygen meter with an accuracy of ± 0.1 mg/l, if needed.
- Thermometer or temperature measuring device calibrated in $^{\circ}\text{C}$ (degrees centigrade) with an accuracy of $\pm 1^{\circ}\text{C}$.
- pH meter with an accuracy of ± 0.1 pH units.
- At least pH buffer standards with pH value below and pH value above the limits anticipated for the samples.
- Conductivity (specific conductance) meter preferably with the capacity to report conductivity (micromhos/cm) correct to 25°C . Functional range of 0 to 50,000 umhos/cm.
- Beaker for field measurement of pH, conductivity, etc.
- Any additional project-specific sampling equipment as required.

2.2.3 Sample Preparation

- Field filter apparatus 0.45 micron membrane filters, and pre-filters when dissolved constituents are to be analyzed.
- A pressure-suction filtration apparatus capable of at least 250 ml volume filtration at any one time.
- Precleaned, capped sample containers containing the appropriate sample preservations, if necessary.
- Tightly capped, securely stored containers holding appropriate preservatives, if necessary.
- Pipet or "squeeze" bottle for preservative additions if such additions are needed.

2.2.4 Sample Containers

- Precleaned, capped sample containers.
- Ice chest(s) to hold collected water samples, and ice or "blue ice".
- Leak-proof liners for ice-chest(s).

2.2.5 Labeling and Shipping

- Water resistant sample bottle labeling materials.
- Laboratory instructions.
- Shipping labels, including DOT labels, waste identification, and "This end up" labels, as appropriate.
- Shipping papers, as provided by carrier or regulatory agency.
- Packing tape.

2.2.6 Cleaning between Sampling Locations

- Laboratory (phosphate-free) detergent.
- Reagent-grade methanol (one to several gallons, depending on amount of equipment to be cleaned, number of sampling locations, and levels of contamination).
- Distilled water, generally about 2 gallons per sampling location.
- Buckets (sufficient for each cleaning liquid and for size of equipment to be cleaned).
- Brushes for cleaning inside of bailer, beakers, etc.
- Handwipes, disposable after each use.
- Plastic sheeting at least one large sheet for each sampling location, for clean layout of equipment.

2.2.7 Record-keeping

- Prepared field record-sheets for entering data collected in the field.
- Photographic record, if appropriate.
- Chain of custody.

2.3 Equipment Cleaning

All items which potentially come in contact with ground water at the sampling location should be pre-cleaned.

Between sites, sampler cleaning is to be performed immediately prior to sampling from any well. Any portion of the sampling device which contacts contaminated water shall be cleaned or disposed of between wells. For example, the cable used for bailing shall be subjected to the same cleaning requirement for a length at least equal to twice the depth to the water surface. Where pumps are used, short sections of sample tubing may be disposed of rather than cleaning. The other items which must be cleaned or disposed of between sampling locations include bailers, pumps, probes, beakers and gloves.

The following procedure is followed for cleaning samplers and equipment:

- o Before first equipment cleaning, clean the buckets and rinse with methanol and distilled water.
- o Fill first bucket with laboratory (phosphate-free) detergent and tap water.
- o Fill second bucket with reagent grade methanol.
- o Fill third bucket with distilled water.

- o Clean equipment thoroughly in lab detergent, using brushes and disposable handwipes as necessary.
- o Rinse thoroughly in distilled water.
- o Lay out cleaned equipment on plastic drop-cloth adjacent to sampling location.

3.0 SAMPLING SCOPE AND CONSIDERATION

1. Prepare field record sheet and record all relevant data.
2. Check the well for above ground damage.
3. Remove the well cap (a wrench may be needed).
4. Lay out equipment on the plastic drop-cloth adjacent to the sampling location, to prevent contamination of or from the outside environment.
5. Measure and record the depth to water and the time of measurement.
6. Measure the total depth of the well.
7. Remeasure and record the depth of water after a lapse of 4 to 8 minutes following initial measurement and record the depth to water and time of measurement.
8. If successive measurements show essentially no difference, continue the sampling procedure. Where the level change is greater than 1/100th ft, delay the remaining procedures until the change observed and recorded is less than that figure.
9. Determine the amount of water in the well (depth of water x cross sectional area).
10. Purge the well.
11. If soundings show sufficient level of recovery, prepare sampling system. If insufficient recovery is noted, allow additional time to collect samples on a periodic schedule which will allow recovery between samplings.
12. Collect volatile organic analysis samples if required.
13. Perform any appropriate field testing of ground-water parameters.

14. Withdraw sample(s) according to correct procedures.
15. Fill necessary sample bottles completely by allowing sampler discharge to flow gently down the side of bottle with minimal entry turbulence. Cap each bottle as filled.
16. Preserve and/or filter the sample if necessary as per guidelines.
17. Check that a Teflon-liner is present in cap if required. Secure the cap tightly.
18. Label the sample bottle with in appropriate tag. Be sure to complete the tag with all necessary information. Complete chain-of-custody documents and field log book.
19. Place the properly labeled sample bottle in an appropriate carrying container maintained at 4°C throughout the sampling and transportation period.
20. Between sampling locations, all items which come in contact with ground water such as bailers, pumps, cables, tubing, probes, gloves, and beakers must be either disposed of or thoroughly cleaned.

4.0 REFERENCES

- Taras, J.J., Greenberg, A.E., Hoak, R.D., Rand, M.D. (editors), 1976, Standard Methods for the Examination of Water and Waste Water, 14th ed.: Amer. Pub. Health Assoc., N.Y.
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- U.S. Environmental Protection Agency, 1974, Methods for Chemical Analysis of Water and Wastes (EPA-625/6-74-003a): Environmental Monitoring and Support Laboratory, Environmental Research Center, Cincinnati, Ohio.
- U.S.G.S., 1984, National Handbook of Recommended methods for Water-Data Aquisition, Reston, VA.
- U.S.E.P.A. Hazardous Response Support Division, 1984. Sampling at Hazardous Materials Incidents.
- Geotrans, Inc., 1983. RCRA Permit Writer's Manual: Ground-Water Protection (40 CFR Part 264 Subpart F). EPA contract no. 68-01-6464.

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PROCEDURE FOR FILTRATION OF SAMPLES

1.0 INTRODUCTION

The sampler should carefully review any proposed procedures for filtering samples on site. Filtration of samples in which volatile organic constituents are of interest is not recommended, since filtration may strip these constituents from the sample. However, filtration of samples in which metals are the constituents of concern may be applicable depending on the proposed analytical method. If total recoverable methods are to be used, the sample should not be filtered. However, if measurement of dissolved metals is desired, the sample should be filtered on site and must be done within 15 minutes of sample collection.

The use of filtering in the dissolved method is designed to remove particulate matter drawn during sampling into the well, through the screen, from the surrounding geologic materials. These particulates may have adsorbed constituents that, once a preservative (particularly acid) is added, may become dissolved in the sample. Thus, if samples truly representative of in-situ ground-water quality are desired, filtering should be required. However, if the goal is simply to detect in the subsurface the presence of a constituent, filtering may not be recommended. Analyzing unfiltered samples may, accordingly, be particularly suitable for detection monitoring. However, establishment of a suitable background may become a problem because water-quality measurements may be strongly influenced by the design and construction of individual wells and the grain size distribution of the formation in which the intake of each well is located. The sampler will need to determine which method is most appropriate for each particular program. In some cases both filtered and unfiltered samples may be collected and compared.

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If mineral precipitation is observed during filtration or if the chemical species of interest are suspected to be significantly present in colloidal form, an unfiltered acidified sample should also be collected and subsequently analyzed for the same parameters as the filtered sample. The containers for the filtered and unfiltered samples must be so labeled and appropriately identified in the field notes.

2.0 PROCEDURE

If filtration is required, the use of a 0.45 micron filter is generally considered appropriate. Occasionally well or surface waters may contain high concentrations of Total Suspended Solids (TSS) such that the 0.45 micron filters will clog during filtering. To avoid clogging, prefilters, available commercially, should be used in addition to the 0.45 micron filters. The filter should also be made of materials compatible with the chemical characteristics of the ground water samples.

Filtration of ground water samples will be performed when appropriate, as summarized in the table below.

<u>Analysis</u>	<u>Sample Collection</u>	
	<u>Filtered</u>	<u>Non-Filtered</u>
Volatile Organics	No	Yes
Total Metals or Ions	No	Yes
Dissolved Metals or Ions	Yes	Sometimes
(acidify after filtration)		

3.0 REFERENCE

U.S. EPA, 1983. Test Methods for Evaluating Solid Waste. SW-846.

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U.S. EPA, 1983. Methods for the Chemical Analysis of Water and Wastes. March 1983. EPA-600/4-79-020.

Geotrans, Inc., 1983. RCRA Permit Writer's Manual: Ground Water Protection (40 CFR Part 264, Subpart F), EPA Contract no. 68-01-6464.

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FIELD MEASUREMENT OF pH IN WATER

1. Scope and Application

This method is applicable to samples of stormwater, surface water, water supplies, and groundwater with measurement occurring at the sampling location.

2. Summary of Method

The pH of water is determined using a portable, field pH meter and a temperature-compensated combination electrode.

3. Apparatus

- A) Haake Buchler pH Meter Stick
- B) 100 ml disposable beakers

4. Reagents

- A) pH reference buffer solutions:

- 1) pH = $4.00 \pm .01$
- 2) pH = $7.00 \pm .01$
- 3) pH = $10.00 \pm .01$

- B) Distilled water

5. Sample Handling and Preparation

Sample aliquots for pH measurement should be obtained directly from the sampling point in 100-ml disposable beakers. Groundwater samples being tested during well purging can be obtained from the pump discharge line.

FIELD MEASUREMENT OF pH IN WATER (Continued)

6. Calibration

Calibrate the meter/electrode using two reference solutions that bracket the expected pH of the sample. Reference solutions should be at room temperature. Immerse the electrode in pH 7.00 solution and adjust the meter as needed. Remove and rinse the electrode and repeat using the second buffer solution. Repeat adjustments until readings are within 0.05 pH units of the reference values.

7. Procedure

Immerse the electrode in the water while gently agitating. After about one-half minute, record the pH reading to the nearest 0.05 units — provided the meter readings are not fluctuating more than ± 0.03 units. BE SURE THAT TEMPERATURE COMPENSATION HAS BEEN PROVIDED FOR. Remove and thoroughly rinse the electrode with distilled water. Repeat the measurement procedure until four readings have been obtained.

8. Interferences

Prolonged immersion of the electrode in turbid solutions can lead to plugging of the liquid junction and erratic meter readings. The electrode should be cleaned by gently blotting with a lab tissue and rinsing with distilled water.

FIELD MEASUREMENT OF pH IN WATER (Continued)

9. Verification of Accuracy

Following the last of the four replicate measurements, immerse the rinsed electrode in each of the reference buffer solutions used to calibrate the meter/electrode prior to sample measurements. If the readings are not within 0.05 units of the reference values, recalibrate the meter/electrode and re-do the measurement of the sample just tested.

10. Assessment of Precision

Calculate the mean and standard deviation of the four replicate measurements. If the standard deviation is greater than 0.1 units, re-do the measurement of the sample just tested, including calibration and verification.

11. Reporting

Report the average value of the replicate measurements to the nearest 0.1 units.

FIELD MEASUREMENT OF SPECIFIC CONDUCTANCE
AND TEMPERATURE

1. Scope and Application

This method is applicable to samples of stormwater, surface water, water supplies, and groundwater with measurement occurring at the sampling point.

2. Summary of Method

The specific conductance and temperature of water is determined using a portable, field conductivity meter having manual temperature compensation.

3. Apparatus

- A) YSI Model 33 S-C-T Meter with weighted probe
- B) 100-ml disposable beakers

4. Reagents

- A) 0.01 N KCl reference solution
- B) Distilled water

5. Sample Handling and Preparation

SAMPLE ALIQUOTS FOR SPECIFIC CONDUCTANCE AND TEMPERATURE SHOULD BE OBTAINED DIRECTLY FROM THE SAMPLING POINT IN 100-ML DISPOSABLE BEAKERS. Groundwater samples being tested during well purging can be obtained from the pump discharge line.

FIELD MEASUREMENT OF SPECIFIC CONDUCTANCE
AND TEMPERATURE (Continued)

6. Calibration

Calibrate the thermometer in the probe against the thermometer in the field laboratory. Readings should be within $\pm 1^{\circ}\text{C}$. Calibrate the specific conductance meter using the 0.01 N KCl reference solution. The specific conductance of this solution is 143 $\mu\text{mhos/cm}$ at 25°C . Adjust the meter as needed. Temperature calibration should be performed weekly. Specific conductance calibration should be performed daily during the period of use.

7. Procedure

Check battery condition by turning selector dial to "Red Line." Adjust meter as needed. Immerse the probe in the beaker while gently agitating. Turn selector dial to "Temperature" and record temperature to nearest 0.5°C . Adjust manual temperature compensation dial to temperature of water. Turn selector dial to "Conductivity" at the scale range appropriate to sample conductance. Record specific conductance to three significant digits. Remove and thoroughly rinse the probe with distilled water. Repeat temperature and specific conductance measurements until four sets of readings have been obtained.

8. Assessment of Precision

Calculate the mean and standard deviation of the four specific conductance measurements. IF THE STANDARD DEVIATION IS GREATER THAN 5 PERCENT OF THE MEAN, RE-DO THE MEASUREMENT OF THE SAMPLE JUST TESTED.

SLUG TEST PROCEDURE

1.0 INTRODUCTION

Slug tests, or response tests, are used to obtain approximate values of transmissivity in small, properly developed wells. Slug tests are simple, inexpensive, and rapidly performed, and may be used when pump tests are not possible or economic. However, slug tests only measure aquifer properties in the immediate vicinity of the well bore. Test results may be unreliable in the presence of a water table, leakage from a confining bed, or partial penetration of the aquifer. If the well is not completely developed, transmissivity will be underestimated. Gravel pack, if present, must be carefully corrected for. Finally, reliable storage coefficients cannot be obtained from slug test results. Storage coefficients should be estimated by some other means (e.g., geologic estimation) in order to approximate aquifer transmissivity with any accuracy.

2.0 EQUIPMENT

- a. Transducer
- b. "Slug" or suspended weight
- c. Wire line probe or steel tape

3.0 PREPARATION

Determine the inside diameter of the well casing. Measure the static water level in the hole with a transducer. The transducer may be calibrated while being lowered into the hole - see Transducer Operation Procedure 5619015. Calculate the volume of the slug and determine the instantaneous head change in the well that will result from introduction or withdrawal of the slug. The slug should displace sufficient water to cause an easily measurable change in head, but it should not change the head more than 20% of the total saturated thickness of the aquifer. Also, introduction of the slug should not cause water to overflow the well casing.

4.0 PROCEDURE

The equations used to analyze a slug test assume an instantaneous recharge or discharge from the piezometer. Therefore, the slug should be introduced or withdrawn from the casing as rapidly as possible without causing undue splashing or turbulence. When the slug is in place, t (time) = 0. Water level readings should be taken in intervals as short as possible (no more than 5 second intervals at the beginning) and gradually increased as the rate of drop decreases. Monitoring should continue until the water level has stabilized.

Values for H (where H equals the head inside the well at time, t , after injection or removal of the "slug", above or below initial head) are calculated by subtracting each water level reading from the initial (H_0) reading.

5.0 CALCULATIONS

Using the values of H , recorded at repeated intervals, values for H/H_0 are computed and plotted on semilogarithmic paper. H/H_0 is plotted on the linear axis of the paper and time, t , in seconds, on the logarithmic scale. Any convenient scale is acceptable for plotting H/H_0 since this number is dimensionless. Plot the values and then curve match, superimposing the field value plot on plate 2 (see Lohman, 1972), to define a match line for a value of t at $Tt/r_c^2 = 1.0$ (match point values of H/H_0 are not needed). Determine transmissivity, T , using:

$$T = 1.0r_c^2/t$$

6.0 REFERENCES

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- Nguyen, V. and Pinder, G.F. 1984. "Direct Calculation of Aquifer Parameters in Slug Test Analysis," in Groundwater Hydraulics, Rosenshein, J. and Bennett, G.D. (eds), AGU Water Resources Monograph 9, pp. 222-239.

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TRANSDUCER OPERATION PROCEDURE

1.0 WATER LEVEL MEASUREMENT

1.1 Lower the transducer probe to the desired level in the piezometer. Attach transducer cable to indicator box by means of connector provided. Switch on indicator and let warm up for ten minutes.

1.2 When indicator is warmed up, note reading and record on data sheet. Simultaneously note barometric pressure and record on data sheet.

1.3 To convert reading to water level, follow the steps below:

1. Calculate the barometric compensation by the following equation

$$\text{Barometer compensation (psi)} = \frac{\text{Barometric Press. (in Hg)} - 14.7}{2.036}$$

$$\text{Barometer compensation (kpd)} = \frac{\text{Barometric Press. (mm Hg)} - 101.3}{7.5}$$

2. Calculate the pressure (psi) acting on the probe by the following equation:

$$\text{head (psi)} = \frac{(\text{reading} - \text{offset}) \times \text{range} - \text{bar. comp.}}{100 \times \text{sensitivity}}$$

3. Calculate the height of water in feet above the probe:

$$\text{height (feet)} = \frac{\text{pressure (psi)} \times 2.308}{(\text{submergence})}$$

4. Calculate water level

$$\text{water level (feet)} = \text{Depth of probe} - \text{height (feet)}$$

1.4 Battery test - Placing the power switch in the BATT TEST position causes the battery test voltage to be displayed. Actual battery voltage is 0.1 of the displayed reading. For a fully charged battery, the voltage should be greater than 6 volts. Do not operate the instrument when the battery voltage is below 5.5. Always recharge the unit as soon as possible after use.

2.0 CALIBRATION OF TRANSDUCER FOR SHORT TERM TESTS

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- 2.1 When a test, such as a slug test, is only expected to last several minutes to a few hours, the transducer may be calibrated on site to eliminate the need for the calculations described above.
- 2.2 Measure the static water level in the piezometer with a wire, line probe, steel tape, or the transducer (utilizing the calculations in section 1.0) then lower the transducer probe to at least three known depths, noting and recording the indicator readout at each depth. When the depth of the probe below water level is plotted vs the indicator value on arithmetic paper, the points should fall on a straight line.
- 2.3 The depth of the probe indicated by subsequent readings within a short period of time can be read directly off the graph, or can be quickly calculated from the equation of the straight line. In order for the method to be accurate, the barometric pressure should not change significantly during the test. Therefore, the barometer should be checked periodically.
- 2.4 Calibration Specifications

Equipment Identification:	Sinco Electrical Piezometer System Model No. 56442-250 Serial No. 41272
Control Number:	61221
Calibration Schedule:	N/A
Equipment Needed for Calibration:	N/A
Calibration Procedure:	Performed by manufacturer.

3.0 REFERENCES

Slope Indicator Company. Undated. Operations Manual, Models 56401 and 56449, Sinco Electrical Piezometer System. Washington. SINCO.

APPENDIX E

GENERAL DECONTAMINATION PROCEDURES

GENERAL DECONTAMINATION PROCEDURES

1.0 INTRODUCTION

In order to reduce risk of transfer of contaminants from areas of known contamination to known clean areas, decontamination of personnel and equipment is required. A description of site area contamination zones is presented in Procedure 5621001. The decontamination procedures shall be established for each site based on the degree of hazard associated with the site and the amount of contact with hazardous materials resulting from site work. Final decontamination procedures shall be reviewed and approved by the site Health and Safety Manager. This procedure contains only general decontamination protocols. Specific decontamination protocols are presented in the REM II Health and Safety Assurance Manual.

2.0 DECONTAMINATION GUIDELINES

2.1 Personnel and Equipment

Decontamination of personnel and equipment is accomplished by washing, and collection of washings and used equipment for treatment, prior to deposition in sealed drums. A general layout of a decontamination line is illustrated in Figure 1.

Decontamination procedures are designed to remove contaminated debris or liquids from protective equipment. Sufficient water and solutions will be available at each site to wash the materials from clothing. Typical decontamination solutions may consist of either 5 percent sodium carbonate (Na_2CO_3) and 5 percent trisodium phosphate (Na_3PO_4) 4 lbs each to 10 gallons of water or 10 percent calcium hypochlorite ($\text{Ca}(\text{ClO})_2$) 8 lbs to 10 gallons of water. Rinse solutions generally consist of 5 percent

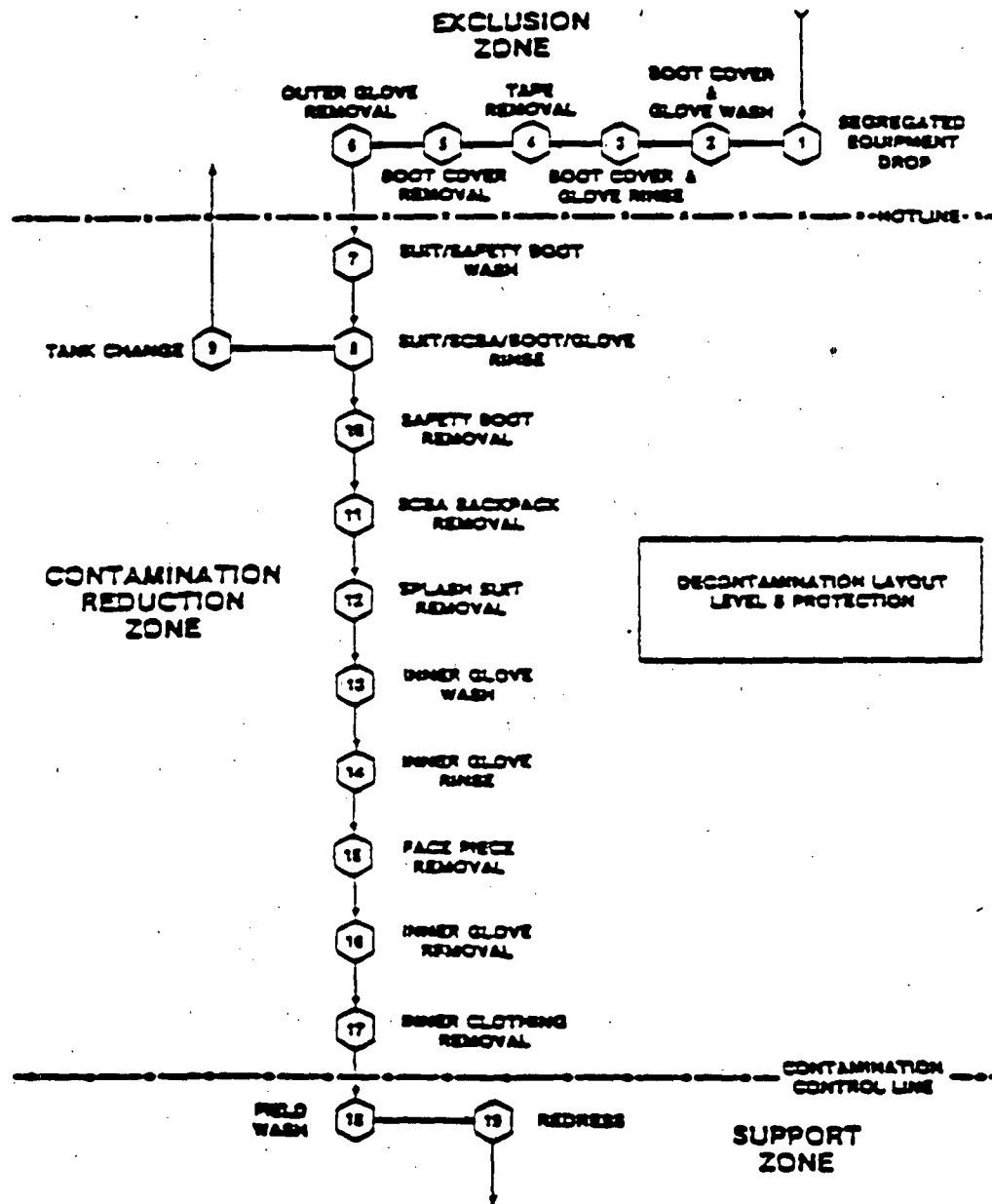


Figure 1 General Decontamination Layout

solutions of trisodium phosphate. Decontamination solutions of dilute HC may also be used when appropriate. The final rinse for all procedures is with clean water.

2.2 Decontaminated Garment Storage

Decontaminated outer garments are stored in a designated area within Zone II. Only those under garments which will be laundered or which do not need to be decontaminated in the decontamination line are brought into the trailer.

2.3 Emergency Decontamination

For emergency decontamination, an outdoor shower shall be located within Zone II and supplied with clean water under pressure. The shower will be located above a grate which allows for collection of all wash waters and a pump for transfer of the used water to properly marked drums for disposal on site.

2.4 Intermittent Work Sites

No decontamination will be required for outer protective clothing as it will be discarded. If equipment becomes contaminated, it should be properly stored and secured in the contaminated zone until a later time when it can be properly decontaminated.